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ABSTRACT

The goal of this report is to describe the process by which new service practices in urban bureaucracies become routinized. The routinization process is studied by examining the life histories of six types of innovations: computer-assisted instruction; police computer systems; mobile intensive care units; closed circuit television systems; breath tests for driver safety; and jet-axes (explosive devices used by fire departments). From this study, it is concluded that routinization of innovations occurs in a series of stages: the improvisation stage; the expansion stage; and the disappearance stage. Effective strategies for promoting routinization are outlined. Findings are also analyzed in relation to specific factors which may facilitate routinization. Implications of the study for further public policy research are discussed. (Author/MC)

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CHANGING URBAN BUREAUCRACIES: HOW NEW PRACTICES BECOME ROUTINIZED

PREPARED UNDER A GRANT FROM THE NATIONAL SCIENCE FOUNDATION

ROBERT K. YIN, WITH THE ASSISTANCE OF SUZANNE K. QUICK, PETER M. BATEMAN, AND ELLEN L. MARKS

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PREFACE

This report was supported by the National Science Foundation under grant no. PRA 76-15207. The work was conducted in an eighteen-month period from August 1976 to February 1978.

The study represents a continuation of previous work by the author on urban innovations and bureaucratic change. Previous studies include:

R. K. Yin, *R&D Utilization by Local Services: Problems and Proposals for Further Research*, The Rand Corporation, R-2020-DOJ, December 1976.

R. K. Yin, Karen Heald, and Mary Vogel, *Tinkering with the System: Technological Innovations in State and Local Services*, Lexington Books, Lexington, Mass., 1977.

The present study also differs markedly from the previous ones, however. It is based on a series of original case studies (and telephone interviews), and it addresses a much more difficult issue--how changes become institutionalized. A series of related appendices to the present report is contained in a companion volume (R-2277/1-NSF).

SUMMARY

THINKING ABOUT ROUTINIZATION

New service practices continually emerge in urban bureaucracies. However, little is known about how such practices become routinized—i.e., how they become part of "standard practice." Ironically, many changes in service practice have continued to occur at a time when federal policymakers have become convinced of the intransigent and rigid nature of urban bureaucracies. The purpose of the present report has therefore been to describe the routinization process.

This process was studied by examining the life histories of six types of innovations:

Type of Innovation	Urban Service
Computer-assisted instruction (CAI)	Education
Police computer systems	Police
Mobile intensive care units (MICU)	Fire
Closed circuit television systems (CCTV)	Education
Breath testing for driver safety	Police
Jet-Axe (an explosive device)	Fire

The life histories were developed through case studies of the use of these innovations at 19 sites, but corroborating evidence was also collected with telephone interviews at 90 other sites. Our sample of life histories often extended over a period of 10 to 15 years. For this reason, a deliberate choice made in the study design was to identify and select a sample of "old" innovations, and then to trace life histories in a post hoc or historical manner. Although organizational memories may be difficult to tap, this procedure avoided the even greater uncertainties that can follow the tracing of "new" innovations forward in time.

The life histories were analyzed in terms of the achievement of ten specific organizational events, which have been conceptualized as either *passages* (transitions from one organizational state to another) or *cycles* (survival over periodic organizational events). The main contribution of this study has been to show how these events are critical to the life history of a specific, innovative practice. In particular, ten passages and cycles were found to be important:

- Equipment turnover (cycle)
- Transition to support by local funds (passage)
- Establishment of appropriate organizational status (passage)
- Establishment of stable arrangement for supply and maintenance (supply)
- Establishment of personnel classifications or certification (passage)
- Changes in organizational governance (passage)
- Internalization of training program (passage)
- Promotion of personnel acquainted with the innovation (cycle)
- Turnover in key personnel (cycle)
- Attainment of widespread use (cycle)

THE INCIDENCE OF ROUTINIZATION

According to the findings, routinization occurs in a series of stages: the Improvisation Stage, the Expansion Stage, and the Disappearance Stage. During the latter two stages, the achievement of the ten passages and cycles serves as the operational criteria for routinization. However, the point at which a practice becomes "routinized" cannot be defined in any absolute sense. Instead of searching for an absolute definition, this study's approach has been to distinguish among three relative degrees of routinization—innovations that have become marginally, moderately, and highly routinized. These three degrees of routinization simply reflected the number (0-3; 4-6; and 7-10) of the ten passages and cycles that had been achieved by any given innovation.

On balance, it was found that a large percentage of the innovations had attained the status of being "highly routinized." In 8 out of 19 case studies (42.1 percent) and 31 out of 90 telephone sites (34.4 percent) this occurred; conversely, 21.1 percent of the case studies and only 20.0 percent of the telephone sites fell into the category of "marginal" routinization. These results are notable in two respects. First, they indicate that many innovations in these two samples—one a stratified sample (the case studies) deliberately chosen to create variation in routinization outcomes and the other a random sample (the telephone interviews)—have lasted and become a virtual part of standard practice. Such encouraging results mean that local agencies can innovate and may not be the bastions of "resistance to change" that they have been typically construed to be.

Second, the percentage of highly routinized innovations is much higher than that found in a recent study of federal innovations in education (Berman and McLaughlin, 1977 and 1978). That study found that none of the innovations had lasted longer than the period of initial federal funding, thereby leaving a much more pessimistic view of innovation. The apparent discrepancy in findings may have two rather simple explanations. First, the present study focused on *technological* innovations, whose hardware components were easier to trace than the organizational innovations that marked the Berman and McLaughlin study. The choice of technological innovations was deliberately made to facilitate the life history approach. Second, this study has also sampled from innovations that had not necessarily been initially supported by federal funds. In fact, about half of the innovations in the case studies were locally initiated and supported. From the local perspective, then, many innovations can be and have been adopted, implemented, and routinized. These simply may not be the innovations included on the agendas of federal agencies.

An initial question that followed the assembling of these routinization scores and ratings was whether there was a simple relationship between routinization and the chronological age of an innovation. The older innovations might have been the more routinized ones, and this alone might have accounted for the pattern of scores. In order to examine this proposition, the data were arrayed along two dimensions: the median age of all the innovations and the degree of routinization. For the case studies, the age of innovation made no difference in predicting the degree of routinization; for the telephone interviews, there was even a slight tendency in the opposite direction—i.e., the younger innovations tended to be more routinized. In sum, the degree of routinization was not related to the chronological age of the innovation.

THE CONDITIONS THAT LEAD TO ROUTINIZATION

The major conditions that lead an innovation to become routinized all appear to be internal to the specific local agency. This is not necessarily an unexpected outcome, but it does suggest that external initiatives (as in a federally initiated agenda) are either limited or will have to be designed with a greater degree of sophistication.

The specific internal conditions involve the role of an innovator (or innovator-team), who must develop agency support for the innovation and establish the appropriate skills and resources for initially operating it. Among the other important initial conditions, some group of agency practitioners must be trained to use the innovation and to begin using it as frequently as possible, preferably in relation to regular agency practices rather than as a special project.

Routinization is now likely to proceed further if the innovation becomes part of a core agency practice. One way of defining a core practice is if the innovation displaces an old practice. Under this definition, the new practice can be routinized more effectively if the capability for carrying out the old practice is systematically removed after the new practice has been installed. This dual tactic is often forgotten by those supporting an innovation, who rightly focus on installing new practices but who negligently fail to attend to the policies needed to terminate the old practices. Another way a core practice is established is when the innovation expands the agency's original array of services. Under this definition, the new practice can be routinized more effectively if the expanded array is formally recognized in a revised version of the agency's mandate. Thus, those supporting the innovation must work for changes in an agency's rules of governance, as reflected in a city ordinance, a bond issue's definition of the "standard" practices that may be financed, or even a perceptual shift reflected in a new agency name or reviews of the agency's budget.

Throughout its early life history, an innovation must continually gain increased support from agency practitioners. This support will result in part if the innovation covers a core practice. However, the innovation must also operate effectively. An effective operation must usually be proven in terms of the individual practitioner's own use of the innovation. Furthermore, some of the criteria by which the practitioner judges an innovation—e.g., convenience, reduced physical effort, additional sense of safety on the job, or elimination of distasteful tasks—are different from those typically held by external evaluators. Thus, for some innovations, external evaluators will not always predict correctly whether there are service payoffs. For other innovations, the role of the coordinator becomes critical. One of the major objectives of the coordinator is to identify specific applications and practitioner groups to which the innovation can be directed. Practitioner support may thus come from any number of subgroups in an agency but is still not likely to be based on the programmatic criteria—e.g., response time, lives saved, changes in student achievement—typically used by external evaluators. The main point is that there may be bureaucratic rather than service efficiency incentives at work, but little is known about the bureaucratic incentive system.

Finally, an important internal condition is the specific support of top agency administrators. These administrators are usually an essential part of the key decisions about an innovation—e.g., to adopt and undertake it, to make staff available through some ad hoc arrangement (e.g., overtime or special hours), or to make

budgetary funds available each year. Without administrative support, most innovations will fail to become routinized (the main exceptions are innovations that may initially be adopted by individual practitioners at no cost to an agency). The administrators appear also to respond to bureaucratic incentives. If an innovation permits an expanded agency budget, for instance, the administrator may have a strong incentive for routinizing the innovation. However, again little is known about the bureaucratic incentive system of top administrators, especially given the confluence of actors—e.g., union representatives, staff from the municipal executive's office, and local legislators who are involved in determining agency policies.

In contrast to these internal conditions, external financial and technical assistance were consistently found to be unrelated to the degree of routinization. This does not mean, however, that local agencies can or will innovate as easily without such external assistance. More likely, the lack of relationship was due to the inability to distinguish between two different conditions—where local officials actively pursue external assistance and where such assistance is the result of initiatives by a federal granting agency or other external agent. External assistance may in fact be important to routinization if such assistance follows local initiatives and matches local needs and agendas.

In summary, several strategies were found to be effective in promoting routinization:

- At the outset, it was important to get the new practice operating on a daily basis, even if this was done by limiting its scope.
- The new practice had to have concrete benefits for service practitioners—e.g., convenience, reduced physical effort, greater potential for promotions, and additional sense of safety on the job. These types of benefits were not necessarily the same as those covered by external evaluators.
- If the new practice displaced an old one, specific steps needed to be taken to eliminate the old way of doing business—e.g., by eliminating the forms and procedures associated with the old way.
- The new practice had to be ultimately expanded to its fullest logical extent, or else it continued to be regarded as a "special project," which precluded it from becoming a standard practice.
- The time lags for achieving the various passages and cycles were different, so that it was important to get an early start on certain activities—e.g., establishing the personnel classifications for any new job skills that may be required by the new practice—to ensure later routinization.

FURTHER RESEARCH

The findings of this study can be regarded as a possible source of new information for policy guidance. Other research—described in the final chapter of the report—will also have to be integrated to develop a firmer set of directives. Nevertheless, the study has suggested many steps that, if confirmed by further research, will allow local policy officials to assess and influence routinization.

For federal mission agencies, policy implementation will involve both the substantive steps directly related to routinization as well as improvements in federal program management. Regardless of the firmness of our knowledge about routini-

zation, no routinization strategies can be pursued unless federal agencies are also prepared to more effectively organize themselves to synthesize the lessons from local experiences, to become more sophisticated in allocating and monitoring the use of federal funds, and to support further research on local organizations.

The problem of delivering neighborhood services to residents—i.e., ensuring public safety, increasing environmental safety, and providing adequate educational, public health, sanitation, and recreational services—has now become a problem for governments at all levels. It is impossible to return to the simplistic era when municipal governments alone could manage these services. Intergovernmental coordination has become a fact of life, but the design of effective policies can only be based on an improved understanding of how actual service practices emerge and become routinized.

ACKNOWLEDGMENTS

This report represents the conclusion of a study that was initiated in August 1976 and supported by the National Science Foundation. Many persons have contributed in one way or another to the effort. Continued assistance has been received from Suzanne Quick (who helped to conceptualize the major issues, participated in the first half of the study, and conducted some of the case studies), Peter Bateman (who conducted many of the case studies), Ellen Marks (who conducted the telephone interviews and their analysis), and Eveleen Bingham (who provided early insights into the routinization problem). In addition, there were a number of officials who helped in the local agencies that we visited or telephoned; without their assistance, the study obviously could not have been conducted.

Throughout the course of the study, many colleagues have also been kind enough to comment on the work or to review preliminary drafts of the report. These occasions included two conferences held in Washington, D.C., on October 20 and 22, 1976. The purpose of these conferences was to suggest ideas about routinization by engaging (1) a group of local officials who had themselves had direct contact with service innovations, and (2) a group of research investigators who had recently conducted empirical studies of service innovations. Within each group, an attempt was made to invite participants acquainted with different local services. The participants were Rae Archibald (former Deputy Fire Commissioner, New York City Fire Department); Philip Cook (Budget Bureau Administration, City of Buffalo, New York); Todd Endo (former Assistant to the Superintendent of Public Schools, Arlington, Virginia); James Morgan, Jr. (former Director of Public Safety, St. Petersburg, Florida); John Teipel (Director, Street and Sanitation Services, Dallas, Texas); Richard Bingham (Department of Political Science, University of Wisconsin at Milwaukee); Ernest House (School of Education, University of Illinois); Henry Lambright (Syracuse University Research Corporation); David Tansik (Management Department, University of Arizona); and Bruce Vladeck (School of Public Health, Columbia University).

The final manuscript was immeasurably improved by suggestions made on an earlier version by three persons—Rae Archibald (The Rand Corporation), Senta Raizen (Director, Dissemination and Resources Group, National Institute of Education), and Lloyd Rowe (Chairman, Department of Political Science, Indiana University, Northwest). J. David Roessner of the Division of Policy Research and Analysis (National Science Foundation) also reviewed the earlier version but his contributions to this work go beyond these specific comments; Dave has continually provoked new insights into organizational innovation during our numerous conversations.

None of the aforementioned persons, of course, is responsible for the final manuscript; nor should Karen Brown (a most unusual editor) and Donna Betancourt, who both tried to make the words more precise and the sentences shorter, be held culpable. Appreciation is due to all these persons for their efforts, but any shortcomings can only be attributed to the author's own lack of imagination and occasional stubbornness.

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Chapter I

LIFE HISTORIES OF INNOVATIONS

It was not so long ago that most people took urban services for granted. As with daily mail delivery, every neighborhood was assumed to have a school, police and fire protection, garbage pickups, and other street services. Most residents were only aware of these services through direct contacts with teachers, police officers, and sanitation and other service workers; but such contacts were few and far between. By and large, the services seemed to take care of themselves. Like the letters that appeared in one's mailbox everyday, the services were just there.

The 1960s changed this. We learned that many urban services were suddenly inadequate. Massive migratory shifts and rising expectations had resulted in new demands that urban schools, police, and other services could not fulfill. The number of problem neighborhoods rose, and people began to talk about "blockbusting," "tipping," and "white flight." Although technological advances had helped the space program and created continued improvements in consumer products, urban bureaucracies remained labor intensive, noninnovative, and inflexible. Whatever the urban riots indicated about the human condition in cities, for instance, they did show that the police still had a lot to learn about peace-keeping tactics.

We also learned that urban services could be costly. And that they could stop. The New York subway workers' strike in 1965 and the city-wide teachers' strike of 1968 (which followed community control initiatives in Ocean Hill-Brownsville and other neighborhoods) were just the beginning of strikes and strike threats across the country that continue to this day. Work stoppages, "sickouts," and collective bargaining became part of the concerned citizen's vocabulary. With the fiscal dilemmas faced by cities and suburban areas over the past several years, urban services have by now been frequently at the center of public controversy. Residents know only too painfully that, if they want services to continue at previous levels, tax rates may have to continually increase or cities may have to find other sources of revenue.

The shift in awareness about urban services also drew Congressional and Presidential attention. Massive federal education aid programs, large-scale assistance to law enforcement agencies, and widespread community development programs were all initiated during the 1960s. Such programs, however, did not evolve from any master plan for improving urban areas or urban services. Thus, each federal program developed its own policies for delivering federal aid. In some cases, as in education aid programs, grants were made to existing state and local agencies; in other cases, as in community development programs, new, locally based nonprofit organizations supported the efforts. For urban residents, the negative effects of federal aid were often more obvious than the positive ones. Local political conflicts —over issues such as the use of federal resources, housing scandals, court-ordered desegregation, and law enforcement assistance that was used for new police gadgets but did not necessarily result in greater public safety—all gave the appearance of further disrupting urban services rather than improving them.

Nevertheless, the message was clear. Something had to be done to change urban services so that they would be more responsive to contemporary demands. Gradually, citizens felt that such changes had to affect the *structure* of urban agencies. Somehow changes had to be made in the way that urban services were organized, and such changes required more than the adoption of a few new practices. In different cities across the country, at least three types of structural changes were attempted. In some cities, "super" agencies were created, with the hope that power would shift upward to a level closer to the municipal executive. At that higher level, it was hoped that residents' priorities could be more easily incorporated into the actions of elected officials, and the inertia of individual agencies could be overcome through better coordination and closer supervision from the executive level. In other cities, decentralization and neighborhood governments were considered, with an equally compelling but opposing rationale: If service agencies had to relate more closely to residents at a district level, the agencies would more responsively serve residents' needs. In yet other places, new nonprofit organizations were initiated to augment the services already provided by existing agencies. Such organizations, e.g., Model Cities agencies or community development corporations, were usually highly dependent upon federal funds. Once again, however, these various strategies for structural change were developed in an uncoordinated fashion. Most cities, for instance, attempted all three types of reform simultaneously, without understanding that conflicting pressures were often created.

In retrospect, these attempts at structural reform have had little lasting impact. Super agencies were easy to create but also easy to dismantle; effective neighborhood governments were difficult to implement in urban areas because of the time and effort required to amend city charters and were never fully developed; newly developed nonprofit organizations had difficulty surviving their original federal auspices, and many failed to become "institutionalized." Moreover, as political priorities shifted at both the local and federal levels, many of the earlier initiatives were reversed. From the vantage point of the late 1970s, in other words, the remarkable accomplishment of the past decade has been the persistence of schools, police and fire departments, sanitation services, and other urban agencies to maintain their basic organizational structures.

This is not to imply, however, that new *service practices* have not evolved. Parents have learned to tolerate classroom procedures different from those of their childhoods that have created a new educational environment for their children. Residents have also become aware of changes in police operations. Some changes, such as the increase in motorized patrol, the common use of walkie-talkies (which did not begin until the 1960s), and the expanded community relations role of the police officer, have become part of the usual police activity currently depicted in television dramas; yet the activities are far different from those romanticized in earlier versions of the old-fashioned "cop on the beat." To take another example, many of the earlier complaints about noisy garbage collection have been eliminated because noise has been reduced through the use of plastic trash bags. There are even some new services, such as the installation of emergency medical teams in many urban and suburban communities. The teams provide paramedic aid that is totally different (and far better) than that traditionally available at the scene of an accident.

The point is that, underlying the political rhetoric and despite the failure of large-scale attempts to change the organization of urban bureaucracies, urban

services have survived and have continued to adopt new practices. Whereas we may have been largely ignorant of how such services were organized before the 1960s, the new perspective of the late 1970s has suggested another blind spot: *We do not know much about the normal evolution of new service practices.* In many respects the excitement of the 1960s created an unfortunate diversion. People expected rapid change, and policymakers took what they believed to be radical initiatives. Attention was incorrectly focused on understanding and even evaluating organizational initiatives. However, whether they were ever properly conceived or not, we ignored the obvious—that service practices are constantly changing (albeit not in the ways that we would always like) and that there is a continuing process of change that must be understood before lasting reforms can be expected.

The research in this report attempts to uncover the processes by which new service practices become routinized. Knowledge about these processes is important for two reasons. First, as already indicated, to the extent that policymakers and residents would like to instigate bureaucratic reforms in the future, such knowledge will help to assure that reasonable initiatives are made and that the results are productive and longlasting. Second, we believe that the normal change processes have been neglected far too long. If the evolution of urban bureaucracies can be considered analogous to the development of a biological organism, then we have failed until now to appreciate the *natural* ways in which bureaucratic practices grow and become modified. Like child or personality development, urban bureaucracies may well follow certain predictable patterns, but these can only be determined if a more naturalistic (and less interventionist) perspective is used to identify the appropriate patterns.

The naturalistic perspective requires service practices to be analyzed in their own terms—i.e., with an ability to accommodate the budgetary, personnel, and organizational reality of every agency. It requires an appreciation for the common features that make school districts operate in a similar manner in different jurisdictions, or that make different police departments appear to operate consistently from site to site. The naturalistic perspective also asks that one accept the incremental nature of urban bureaucratic change. Thus, although a specific innovation may appear to be only "tinkering with the system," the aggregate effect over the long-term may be substantial.[1]

Only one previous research study, Anthony Downs' *Inside Bureaucracy* (1967), has strikingly captured this naturalistic perspective in the past. However, Downs was mainly concerned with the birth and death of *federal* bureaus. He also conducted his study at an earlier time when case study analysis for policy purposes was not a refined activity, and he thereby had less access to specific experiences as evidence for his conclusions. Nevertheless, Downs provided many insights into the nature of the federal bureaucracy, and we hope that our research as reported here, based on 19 case studies and a telephone survey of 90 other sites, will equally enlighten the reader.

The Life History Approach

Focus on Innovations. To analyze changes in service practices, this study

[1] The author has previously written about the usefulness of the naturalistic perspective and the degree to which change in urban bureaucracies takes an incrementalist form. See Yin, Heald, and Vogel (1977), especially pp. 4-7 and 126-130.

takes advantage of the numerous specific innovations—i.e., new practices—that different agencies have implemented in the past. The major objective has been to trace the "life history" of different innovations (a term first used by Tansik and Radnor, 1971)—i.e., from the point that they were first adopted to a point where the innovations have more or less disappeared as "innovations" and are regarded as an integral part of *standard practice*. The focus on specific innovations does injustice to the richness and complexity with which urban bureaucracies are constantly changing. Nevertheless, without such a focus, the study of organizational change would be too slippery; like the chronicler but not the historian, one would not know what changes were significant or be able to produce a meaningful picture.

Innovation life histories provide such a focus. In fact, any innovation appears to undergo a complex sequence of changes before it can be said to have become a part of the agency's routine functions. An innovation that has been integrated into standard practice has generally passed through three phases of change:

- *Initiation and adoption.* A specific series of events occurred, during which the innovation was considered for adoption; some pilot testing may have occurred on a small-scale basis; and the results of that testing resulted in a decision to adopt the innovation.
- *Implementation.* A subsequent series of events occurred, during which broader support for the innovation was developed; plans were made for instructing and training relevant practitioners throughout the service; the innovation was introduced as widely as resources would permit; and implementation results were monitored.
- *Routinization.* Another series of events occurred, as a result of which the innovation no longer appeared as an innovation but became part of the common services routinely provided. (One characteristic of this stage is when a local agency can no longer return to a previous way of doing business, although some new innovation may occur to supplant the routinized one.)

These phases are not easily defined, nor do they necessarily bear simple relationships to each other. The labels may be considered akin to such other life-stage labels as infancy, childhood, adolescence, and adulthood. For instance, by certain criteria, adolescence may begin much earlier and end much later than by other criteria. Similarly, some aspects of childhood may be found in adulthood even though the stages are separated by adolescence.

The general notion, however, is that the phases in the bureaucratic change process have distinct characteristics, and that the phases occur sequentially over time. Unfortunately, the vast majority of research on innovations has been concerned with the earlier phases of the innovative process, either adoption or implementation.[3] In contrast, the available research on the *routinization process*—also referred to as *incorporation* or *institutionalization*—is sparse. Thus, little is known about the factors that facilitate or discourage routinization. In short, previ-

[3] In fact, so many individual studies have been done that entirely separate volumes (e.g., Zaltman et al., 1973; Rothman, 1974; and Public Affairs Counseling, 1976) have summarized the numerous findings on the initial importance of performance gaps, slack resources, chief executive support, practitioner training and preparation, and impetus for innovation from *within* the adopting agency.

ous research on urban services has failed to focus on how new practices ultimately become institutionalized in a bureaucratic setting.

Without understanding routinization, researchers cannot appreciate the nature of bureaucratic change, and policymakers cannot intervene if routinization fails to occur where desired (or vice versa). This lack of understanding can have serious consequences. For instance, failure at the routinization phase can be more costly than failure at either of the other two phases, because an innovation is likely to have incurred full-scale costs and shown some merit (unlike innovations that may have failed at the implementation stage). Second, failure to routinize can be a disruptive process for the specific persons who have been associated with an innovation; they may have invested significant portions of their careers in developing skills associated with an innovation, often at the expense of foregoing other opportunities. For these reasons, it is important to understand the routinization process and to develop guidelines for federal and local officials concerned with innovations. There may even be strategies that these officials can undertake at the outset of an innovation's life history to assure subsequent routinization.

Illustrative Life Histories. The value of using specific innovations as an opportunity to study bureaucratic change may be illustrated by reviewing a few life histories. The following are derived from the 19 case studies conducted as part of this study, and subsequent chapters refer to various aspects of these studies. The four examples presented here are typical of many of the life histories and include one where routinization has been completed, one where the innovation has been operating at an incompletely routinized stage for several years, one where the nature of the innovation changed, and one where the innovation is no longer in use.

In *Life History A*, the innovation consisted of a mobile intensive care unit (MICU) program that began early in 1973 with the purchase of a single emergency vehicle and the training of 17 firefighters to serve as paramedics. A one-year federal grant helped to support the operation, but the community had been anxious to initiate such a service for several years. This was in part because of two accidents, a furnace explosion that killed nine people and another accident that killed two young high school coaches; many felt that more lives would had been saved if on-site medical attention had been available.

After the first year, local fire department funds were used to support the innovation, which has subsequently undergone substantial expansion. The MICU service currently consists of 6 vehicles, and 76 firefighters (about 15 percent of the entire department) have received paramedic certification. Nearly half of the fire alarms in the city now call for an MICU vehicle, and the program has attracted considerable public interest. Recently the mayor made city funds available for fire officers to begin a large-scale citizen training program in cardiopulmonary resuscitation. The head of the MICU committee that oversees the service also serves as chairman of the state and national MICU committees.

Changes have occurred within the fire department as well. MICU equipment and supplies are now purchased with the same procedures as other fire equipment, but the procedure has been facilitated by the fact that the purchasing agent has taken a paramedic course, is an MICU enthusiast, and understands in detail the variety of necessary equipment. The paramedic position has been given civil service status; more important, however, the MICU program has been structured so that the paramedic assignment will not be a dead-end job. One paramedic and one

lieutenant typically comprise an MICU unit. When the lieutenant is promoted to captain, he leaves the unit and thus creates a position to which others can be promoted. This also means that, over time, officers who have been part of the MICU service will move to higher-level positions in the department. Other changes in the department have included the establishment of standard operating procedures for the service, the initiation of a regular training program, the formalization of paramedic certification and recertification procedures as part of state licensing requirements, and the development of solid working relationships between fire and health practitioners (for instance, emergency room nurses have worked with the emergency medical teams in answering calls to become familiar with the MICU operation, and the paramedics have demonstrated their skills to various hospital staffs).

Two other events are particularly noteworthy. In the last year or two, the MICU service has enabled the fire department to maintain its established level of staffing (due to the increased workload imposed by the MICU service), while other city agencies have experienced budgetary cutbacks. In addition, the title of the fire department has been expanded to include the words "rescue service." In sum, the MICU innovation, in an interval of only a few years, has become an integral part of the services provided by the fire department.

In *Life History B*, the innovation was a computer-assisted instructional (CAI) program for a school district. Although the school district had used its own computer for administrative purposes since 1961, it was not until 1972 that teletype terminals were acquired for instructional applications. In such applications, a student does his or her own programming on a terminal, or simply solves mathematics problems on an individual basis. The innovation was initiated by a mathematics teacher who had become the mathematics supervisor for the district; complementary technical support in maintaining the equipment has been provided by the district's data processing unit.

Financial support for the CAI innovation has consistently come from the district's own funds. As a result of the innovation, computer programming and advanced computer mathematics courses are now offered by the district. Over the years, however, the number of CAI terminals has only increased from nine to ten terminals (one each for all but one of the high schools). In part, the small number has been due to the limited amount of core computer time, which is mainly dedicated to administrative and other school-related functions but not to instructional use. In part, however, the limited size of the innovation is related to a lack of strong demand by students or teachers for CAI applications. Many teachers are enthusiastic about CAI but only one round of in-service training was formally offered, and most teachers, including those in subjects other than mathematics, are largely unaware of the ways in which CAI can be integrated into their classroom activities.

The innovation in Life History B has thus survived an initial period of adoption and implementation, but has remained at a stable level since its initiation. Other than the creation of special computer mathematics courses, CAI has not become an integral part of the school curriculum. Most students and teachers in the district have no contact with CAI; there is no formal training program for teachers; practitioner certification to teach in the school district does not include any requirement to have a computer background or CAI training; and there have been few changes in formal operating procedures (e.g., no adoption of CAI-oriented textbooks).

Nevertheless, CAI may continue in this fashion for an indefinite period of time. Individual schools have purchased their own minicomputers and additional terminals as part of the capital expenditures for a new wing of a school building, and the mathematics supervisor remains enthusiastic about CAI. In sum, the CAI innovation in this district is still active but it has not yet become an integral part of the educational services provided by the district.

In *Life History C*, a closed circuit television system (CCTV) was installed in a school district, and the first television programs were transmitted in 1969. Each week, two 15-minute programs for grades three, four, and five were produced in social studies, science, and art. The programs were designed to correspond with the topics that students would study in their classes, and students in nine elementary schools viewed the programs as part of their classroom work. The main goal of the CCTV operation was to improve the education of students from low-income families, and much of the initial funding came from a three-year state and federal award.

Although this innovation operated successfully for a year, with appropriate in-service training available to teachers, and although the district had made viewing such programs a mandatory part of the curriculum at these nine schools, the innovation had dramatically changed two years later. This was because the entire district implemented a formal decentralization plan in 1970, in which the original district was divided into three administrative subdistricts. Each of these subdistricts had full control over the development and administration of its own instructional program, with its own superintendent and citizen advisory committee. Moreover, the nine original elementary schools were equally divided among the new subdistricts. The decentralization made it impossible to continue the program of mandatory viewing of the CCTV programs, and the whole CCTV operation stagnated for about a year and a half.

Eventually, a new television coordinator was appointed as part of a central service, the educational media department. Since 1974, this new coordinator has helped the subdistricts to develop a considerably revised innovation, focused around instructional television (ITV) but not CCTV. The new coordinator has rejected the "down the line" transmission arrangement in which a single program is sent to many classrooms simultaneously; instead, he has fostered a grass roots approach in which teachers are encouraged to adapt television to their individual classroom needs. Thus, when the five-year lease with the telephone company for cable services expired shortly after the new coordinator's arrival, he decided not to renew that contract and instead applied the funds to the purchase of video equipment (e.g., videotape recorders, monitors, and portable cameras) to be shared by schools throughout the district.

The new system is itself now being slowly integrated into the district's organization. The district is able to maintain and repair the television equipment; new civil service classifications have been established for the technical staff positions associated with the operation; a variety of local funding sources is used to support the system; and a television production studio has emerged as a mandated part of the curriculum of one of the high schools. However, the innovation as presently implemented is not a CCTV system, in which programs are actually transmitted from one classroom to another or from one school to another. Thus, in this life history, the original innovation has ceased, but it has been replaced by a related

innovation that appears more suitable to the needs of a decentralized school district.

Life History D also involves a CCTV system. In this case, state funds were initially used to help purchase and install a microwave-cable system in which three channels were made available to transmit programs to about 1,200 television sets located in classrooms throughout the district. Because it was an ambitious project, most of the period of the state grant (1963-68) was used to implement the system. Various technical difficulties were encountered. The wiring process progressed slowly, but by 1967, 52 schools were wired and receiving programs. In addition, the district had a fully equipped television studio, two full-time technicians to service the system, new civil service classifications for the staff related to the CCTV system (who were located in a separate television department in the district), and a sufficient number of self-produced or purchased television programs to utilize all three channels fully during the school day. In addition, when state funding finally ended (the grant had involved a declining share of state funds for the five-year period), the system was then entirely supported by local funds. The system had also received consistently strong support from the district superintendent.

Budget cutbacks during 1969 and 1970, however, increased pressure on the district to reduce and eliminate the CCTV system. The original superintendent departed; teacher resistance to the innovation increased in the form of formal union oppposition; and by 1971 the entire television department had been disbanded and much of the television equipment sold to another district and to the local public television station. Today, there is only sporadic use of the original CCTV system. (The microwave and cable connections are still functional.) Individual schools may use television in the classroom, and at least one high school has its own production studio. However, there is little or no central coordination, and the sporadic use has not been sufficient to warrant the judgment that the CCTV system as a whole has survived. In fact, the earlier budget cuts quite clearly eliminated the system, along with other specialized educational programs such as driver education.

Changes in Service Practices—The Key Questions. The four life histories offer a glimpse of the variety of experiences that different innovations can undergo within local service agencies. Yet, their experiences can also tell us a lot about the nature of change within urban bureaucracies. A fundamental question has to do with the routinization process itself—*What operational characteristics reflect the life history of a new service practice as it becomes routinized?* Few previous investigations have defined the concrete organizational changes that occur, and therefore such concepts as routinization until now have remained abstract and only loosely amenable to empirical study. In contrast, the major contribution of this study will be to define the routinization process in an operational and rigorous form.

A second question has to do with explanations for routinization outcomes—*Why do some innovations survive over a long period of time and eventually become routinized, and why do others fail to do so?* The common initial responses to this question are not satisfactory. For instance, it has generally been thought that the new practices that survive are those that demonstrate a clear service improvement. Indeed, much of the work in evaluation research for public programs is based on this premise. However, in the four cases just described, the service payoffs for the first innovation were not any more evident than those for the last three, and this is thus an insufficient explanation for the eventual outcomes. In fact, in none of

these four cases, and in few of the other case studies among the remainder, was there any formal evaluation of service payoffs or a clear understanding of the possible payoffs. A second common notion has been that the decision to fund an innovation with local monies is the major distinction between those that survive and those that do not. Again, all four cases described and nearly all the remaining cases had become fully supported by local funds, and yet this did not guarantee long-term survival. A third common observation is that innovations that fail to become implemented properly are those that fail to survive. Yet in Life History D, the innovation was fully operational and covered most of the schools within the school district. Thus, success during the implementation stage does not assure that an innovation will survive. A fourth common hypothesis is that the passage of chronological time itself is a major factor in routinization. Yet, of the four illustrative cases, the one that had been most routinized (Life History A), was also the case with the shortest history.

Other apparent explanations are actually somewhat circular. An observer close to Life History D, for instance, noted that the budget cutbacks that had led to the end of the CCTV system also affected other special education programs, such as driver education. Thus, one common explanation has been that innovations that only result in "special" activities or programs are not likely to survive. But this explanation begs the question, for it is the very distinction between a "special" and a "routine" activity that we would like to understand. In short, we need to know what makes an innovation remain special, and which factors in contrast lead to an innovation becoming a routine activity of a bureaucracy.

Any deeper probe, of course, fully reveals the weak nature of our knowledge base. None of the previous explanations offered, for instance, can even begin to distinguish the two situations in Life History A and Life History B: In both cases the innovation had clearly survived for a period of time beyond any "pilot" or "demonstration" period, but the first innovation continued to grow and became a part of much of the basic organizational routine of the agency, while the second innovation remained in a stagnant state.

In summary, the task of this study is to describe the process of change in urban bureaucracies and thereby to begin to explain these different outcomes. Only with such information will we be able to understand how new practices typically evolve in urban bureaucracies. And only an understanding of the typical will enable us to think about designing successful interventions.

Evidence Used in This Study

The subsequent chapters of this report provide more detail on the procedures used in this study. However, the general features are worth summarizing here.

Case Studies and Telephone Interviews. The actual life histories of six types of innovations in different cities were based on 19 on-site case studies, augmented by telephone interviews covering 90 additional cities. The six types of innovations, which are fully described in the next chapter, were:

Type of Innovation	Urban Service
Computer-assisted instruction (CAI)	Education
Police computer systems	Police
Mobile intensive care units (MICU)	Fire
Closed circuit television systems (CCTV)	Education
Breath testing for driver safety	Police
Jet-Axe (an explosive device)	Fire

The data were all collected during the winter of 1976-77 and spring of 1977.

The two methods of data collection were used because of their complementary nature. (Appendix A describes their differences and some recent research that has applied them to the study of bureaucratic innovation.) On-site case studies involve a series of personal interviews at the same site. The case study also enables an investigator to observe an innovation in practice and other characteristics of the local service organization. The case study approach was used because the state of knowledge about organizational change processes is still primitive, and the approach thus provided the flexibility needed to trace life histories and to develop notions about a bureaucratic change process that has only been poorly understood in the past. Such case studies, however, were limited in number because of the time and effort required to conduct each case study. For this reason, other sites were more superficially covered through the use of structured telephone interviews, in which a single respondent was queried about the situation at a whole site.[3] The larger number of sites thus permitted generalization to a wider array of cities than was possible with the case studies alone.

Aside from these inherent differences between on-site case studies and telephone interviews, the two methods of data collection were treated similarly in other procedural respects. These included: (1) the selection of cities to be studied, (2) pilot-testing and the development of specific instruments, and (3) preparation of the data for analysis.

City Selection. The innovations pertinent to this study were those that had been adopted some time ago by a local agency. Therefore, six lists of cities were developed, one for each type of innovation. Each list was based on previous studies that had specified that an adoption had occurred.[4] For the case studies, a sample of cities from each list was pre-screened[5] via a brief telephone call to determine whether the innovation had survived or not over the years. The sites for the case studies were chosen to ensure three types of variations with regard to this outcome: over five years and still used, between two to five years and still used, and once used

[3] The selection of a single respondent represented a tradeoff between an attempt to gain a diverse set of responses about a single innovation and an attempt to cover numerous innovations. The latter was chosen, with the single respondent identified as a person knowledgeable about the innovation (usually the coordinator). To minimize biases, the telephone interview emphasized "facts" about the innovation (e.g., the initiation date, the services provided, the existence of an in-service training program or of federal funds, etc.) rather than interpretations concerning its use. Nevertheless, for such a complex topic as organizational innovation, telephone interviews of additional respondents for the same innovation would be desirable in the future.

[4] The studies were as follows: for CAI, Bukoski and Korotkin (1975); for police computers, Colton (1972a), Kraemer et al. (1976), and Bingham (1976); for CCTV, Wigren et al. (1967); for MICU, National Emergency Medical Services Information Clearinghouse (n.d.); for breath testing, no specific study but sites randomly selected from cities between 250,000 and 1 million; for Jet-Axe, Feller, Menzel, and Kozak (1976).

[5] The six prescreening instruments (one for each type of innovation) are contained in Appendix B.

but subsequently undergoing some cutback or curtailment. However, it was not always possible to find such sites with the brief pre-screening procedure, and travel and scheduling constraints did not always allow the precise implementation of this plan. Nevertheless, *the 19 case studies represented a stratified sample*, covering a variety of routinization experiences for each type of innovation. The cities that were subsequently visited are listed, according to type of innovation, in Table 1.

For the telephone interviews, all cities in the original six lists (corresponding to the six types of innovation) were used, excluding those that had been selected for site visits. The initial telephone interview occasionally revealed, however, that the city did not really qualify for study, usually for one of the following reasons:

- The initial adoption had actually not occurred.
- The innovation had been incorrectly defined at the outset and was not one of the six types.
- The adopting agency was incorrectly defined at the outset and was not a school district, police department, or fire department.

These disqualifications limited certain innovations such as police computers and CCTV to about 16 cities each; it was thus decided to randomly select from the lists of the four other types of innovations until 16 cities for each had been identified. Thus, except for police computers and CCTV (where the entire universe was included), *the telephone interviews represented a random sample of previously identified adoption sites*. Table 2 shows the full list of cities in which telephone inter-

Table 1

19 Case-Study Sites, by Innovation

Innovation/City	1970 Population (thousands)	Innovation/City	1970 Population (thousands)
CAI		CCTV	
Dallas, Tex.	844	Omaha, Nebr.	347
Oakland, Calif.	362	Portland, Oreg.	380
San Diego, Calif.	697	Rochester, N.Y.	296
Tampa, Fla.	278		
		Breath Testing	
Police Computer			
		Akron, Ohio	275
Boston, Mass.	641	Cincinnati, Ohio	451
Indianapolis, Ind.	746	Memphis, Tenn.	624
Miami, Fla.	335		
Nashville, Tenn.	448	Jet-Axe	
		Omaha, Nebr.	347
MICU		Rochester, N.Y.	296
Birmingham, Ala.	301		
Dallas, Tex.	844		
Denver, Colo.	516		

views were conducted.[6] (Some cities appear more than once because the list for each type of innovation was separately developed, and the same city may have adopted more than one innovation.)

In general, the cities that were studied, both by on-site case study and by telephone interview, ranged from 250,000 to 1 million in population. (A few cities under 250,000 had to be included for some of the innovations in order to fill the necessary sample size; the five major cities over 1 million in population were categorically excluded from study because of their size.) It is important to note, however, that the relevant organizational unit was not a city per se, but one of three service agencies: a school district (for CAI and CCTV), a police department (for police computers and breath testing), or a fire department (for MICU and Jet-Axe). Thus, if it was found that a city had adopted one of the six innovations but that the adoption had not been by one of these three agencies, the city was not considered eligible for study. This exclusion criterion mainly affected police computers, where a large number of police departments are now users of a city computer system; the eligible cities only included those where the department owned (or leased) and operated a core computer itself.

Pilot-testing and Instruments. Two different types of instruments were used for data collection. For the on-site case studies, an interviewer's guide was prepared (see Appendix B). For the telephone interviews, six different questionnaires were designed, one for each type of innovation (also see Appendix B).

These instruments and other field procedures, such as the problems of identifying the main respondent to be interviewed (usually the official who coordinated the use of the innovation), were developed in an explicit *pilot-testing phase* of the study that preceded the formal data collection effort.[7] The pilot phase was aimed at developing hypotheses about routinization, clarifying certain substantive issues, and identifying potential methodological problems. For instance, it was found during this phase that no single instrument was sufficient to conduct telephone interviews for six different types of innovations. The pilot testing was conducted during the period from August to December of 1976; final instruments were designed in January 1977, and the final case studies and telephone interviews were conducted from February to July of 1977.

Preparation for Data Analysis. For case studies, a problem that is often overlooked by investigators conducting a series of case studies is the aggregation problem. This problem has to do with the manner in which general lessons are drawn from the array of case studies that has been conducted. Few investigators understand that the problem is aggravated by certain types of data collection, and that the problem must therefore be anticipated in the design of the initial fieldwork. For instance, if information is collected in an inconsistent manner at different sites, later aggregation is nearly impossible. As another example, the individual case studies may contain too much information and thereby create an enormous problem of data reduction.

Because each case study followed the same interviewer's guide, each was written in a narrative form that was organized around the same subtopics. Eight representative case studies have been fully edited, reviewed by the relevant local

[6] The telephone interviews ultimately covered 90 of the 96 sites selected because of call back difficulties at 6 of the sites.

[7] The pilot-phase is fully described in an unpublished paper, R. K. Yin et al., "Routinization III: Research Methods for Phase II," The Rand Corporation, January 1977.

Table 2

90 Telephone Interview Sites, by Innovation

Innovation/City	1970 Population (thousands)	Innovation/City	1970 Population (thousands)
CAI		MICU	
Atlanta, Ga.	497	Baltimore, Md.	906
Baltimore, Md.	906	Cincinnati, Ohio	451
Birmingham, Ala.	301	Gary, Ind.	175
Denver, Colo.	516	Jacksonville, Fla.	529
Fort Worth, Tex.	393	Kansas City, Kans.	507
Honolulu, Hawaii	325	Madison, Wis.	172
Kansas City, Mo.	507	Memphis, Tenn.	624
Louisville, Ky.	362	Phoenix, Ariz.	582
Newark, N.J.	382	Portland, Oreg.	380
New Orleans, La.	593	St. Paul, Minn.	310
Phoenix, Ariz.	582	Salt Lake City, Utah	176
Rochester, N.Y.	296	Seattle, Wash.	531
St. Louis, Mo.	622	Toledo, Ohio	383
Toledo, Ohio	383	Tucson, Ariz.	263
Tucson, Ariz.	263	Warren, Mich.	179
Wichita, Kans.	277		
		CCTV	
Police Computer		Anaheim, Calif.	166
Baltimore, Md.	906	Atlanta, Fa.	497
Birmingham, Ala.	301	Fresno, Calif.	166
Buffalo, N.Y.	463	Honolulu, Hawaii	325
Denver, Colo.	516	Indianapolis, Ind.	746
Kansas City, Mo.	507	Milwaukee, Wis.	717
Long Beach, Calif.	359	Phoenix, Ariz.	582
Louisville, Ky.	362	St. Louis, Mo.	622
Oakland, Calif.	359	Salt Lake City, Utah	176
St. Louis, Mo.	622	San Jose, Calif.	447
San Diego, Calif.	697	Santa Ana, Calif.	156
Seattle, Wash.	531	Seattle, Wash.	531
Tucson, Ariz.	263	Springfield, Mass.	164
Washington, D.C.	757	Tucson, Ariz.	263
Breath Testing		Jet-Axe	
Atlanta, Ga.	497	Charlotte, N.C.	241
Austin, Tex.	252	Cincinnati, Ohio	451
Baltimore, Md.	906	El Paso, Tex.	322
Dallas, Tex.	844	Honolulu, Hawaii	325
Indianapolis, Ind.	746	Jacksonville, Fla.	529
Jacksonville, Fla.	529	Kansas City, Mo.	507
Jersey City, N.J.	260	Louisville, Ky.	362
Kansas City, Mo.	507	Minneapolis, Minn.	434
Minneapolis, Minn.	434	St. Paul, Minn.	310
New Orleans, La.	593	St. Petersburg, Fla.	216
Oklahoma City, Okla.	368	Salt Lake City, Utah	176
St. Louis, Mo.	622	San Francisco, Cal.	716
San Diego, Calif.	697	Santa Ana, Calif.	156
Seattle, Wash.	531	Tucson, Ariz.	263
Tampa, Fla.	278	Worcester, Mass.	177
Tucson, Ariz.	263		

agency, and reproduced in Appendix C. (The other 11 are available from the author on request.)* After the narratives were completed, a summary table of events was prepared (see Chapter IV), dividing the life histories of each innovation into three chronological stages. This summary table serves as the main evidence from which the general observations and conclusions from the case studies have been drawn. In short, the **chain of evidence** from *data collection instrument* to *narrative case study* to master *table of events* to *general findings* has been traced as explicit steps, and the entire procedure is in principle susceptible to replication.

For the telephone interviews, the responses to each of the six original instruments were separately tabulated. Identical and comparable questions were then combined across instruments, so that the responses for all 90 sites could be tabulated together. The results of these tabulations, in simple descriptive form, are contained in Appendix D. These data were then used for all the telephone interview analyses described in Chapter VII.

For both the case studies and the telephone interviews, the emphasis throughout the data collection was on the occurrence of organizational events. For this reason, the measurements used mainly consisted of items scaled along nominal or ordinal dimensions. Such items were analyzed individually in relation to routinization outcomes, but no multivariate analysis was attempted. Because the objective of the study was to describe life histories of innovations and to provide a new framework for assessing routinization, the study did not attempt to develop the refined set of interval-scaled items that would have allowed multivariate analysis. Such refinements have been suggested as appropriate tasks for further research (see Chapter VIII).

Limitations. Because any single study must be limited to some set of specific innovations and body of evidence, the generalizability of the conclusions can always be questioned. Thus, although the conclusions presented in this study should demonstrate *internal validity* (i.e., they should draw logically from a research design and data collection methods that are internally consistent and unbiased), it is important to discuss the extent to which the study is either generalizable or limited regarding *external validity* (i.e., the degree to which the conclusions are applicable to situations other than those directly studied).

The study appears to be generalizable beyond the immediate innovative situations in the following manner. First, the case study visits and telephone interviews covered a variety of geographic areas and appear to fully reflect a national sample of cities of 250,000 to 1 million in population. (The five largest cities—New York, Chicago, Los Angeles, Philadelphia, and Detroit—were omitted from the study because of the distinctive complexity of their local public agencies.) Second, the study covered a sample of innovations that has been divided according to a meaningful conceptual distinction—task-specific and task-diverse innovations (see Chapter II)—and the results may therefore be extended to other types of innovations to the extent that they can be classified into this scheme. Third, the study included three of the most common types of urban services, and the results should be generally applicable to the entire array of urban service agencies found in medium-

* Each case study was sent in draft form to the local agency for corrections and editing. In addition, the agencies were asked whether their jurisdictions could be named or whether they wished to be cited anonymously in the final case study. Eight jurisdictions indicated their willingness to be named, and these are the case studies reported in Appendix C. The remaining jurisdictions asked to be anonymous. These case studies are available from the author on request.

sized local jurisdictions. Whether the organizational principles that emerged from the study may also be applicable to bureaucracies in general, and not just local public agencies, can of course be further tested. (Informal observations of other public and private bureaucracies suggest that the routinization process described here may not be different from that found in other types of organizations.)

In contrast, the study appears to be limited in the following manner. First, the study focused on innovation life histories that occurred in the last 15 years. Although some of the innovations had begun earlier, the bulk of the results are constrained by the political and bureaucratic environment of the last 15 years. Such a period of time covers more than a single cohort of innovations (because, among other things, local and federal conditions have changed so rapidly even within this period of time); nevertheless it may be true that future innovations will be taking place in a very different environment, and to this extent the generalizability of the study's conclusions will be limited. Second, although the study focused on six different types of innovations, all were embodied in some hardware or physical apparatus. The life histories of "hardware" innovations were the target of study because their artifacts and functions could be more easily traced over time. Innovations that do not have such a physical embodiment may result in different experiences in local organizations; however, it is also possible that "software" innovations involve the same routinization process but are more difficult to trace. Overall, the distinction between hardware and software innovations has been inadequately studied, so the study's conclusions must tentatively be considered limited to hardware innovations.

On balance, the results and guidelines from the study do not suffer from the idiosyncracies that would have occurred had the study been limited to: one type of innovation (many adoption and diffusion studies are of this nature); one type of service agency (many policy studies are of this nature); or one or two specific jurisdictional sites (many academic case studies are of this nature). On the contrary, the conclusions regarding routinization may be applicable to most of the innovative situations encountered by a contemporary local service agency in medium-sized cities.

Summary of Study

New service practices continually emerge in urban bureaucracies. However, little is known about how such practices become routinized—i.e., how they become part of "standard practice." Ironically, many changes in service practice have continued to occur at a time when federal policymakers have become convinced of the intransigent and rigid nature of urban bureaucracies. The goal of the present report is therefore to describe the routinization process. The lessons drawn are an attempt to develop insights into how service practices *normally* change. This development of "normal" theory is a necessary precursor for designing any intervention strategies, and it has been a void in previous policy research.

The routinization process was studied by examining the life histories of six types of innovations (described in Chapter II) at 19 case study sites and 90 telephone interview sites. The life histories were analyzed in terms of the achievement of ten specific organizational events, which have been conceptualized as either *passages* (transitions from one organizational state to another) or *cycles* (survival over periodic organizational events). These concepts, as well as several factors

hypothesized to facilitate the achievement of passages and cycles, are fully elaborated in Chapter III.

According to the findings, routinization occurs in a series of stages: the Improvisation Stage (Chapter IV), the Expansion Stage (Chapter V), and the Disappearance Stage (Chapter VI). During the latter two stages, the achievement of the ten passages and cycles serves as the operational criteria for routinization. These include: the passage from external to internal funding, the establishment of personnel classifications or certification, changes in organizational governance (in one case, the name of the agency was actually changed to accommodate the new practice), and the appropriate turnover of personnel. Several strategies were found to be effective in promoting routinization:

- At the outset, it was important to get the new practice operating on a daily basis, even if this was done by limiting its scope.
- The new practice had to have concrete benefits for service practitioners—e.g., convenience, reduced physical effort, greater potential for promotions, additional sense of safety on the job. These types of benefits were not necessarily the same as those covered by external evaluators.
- If the new practice displaced an old one, specific steps needed to be taken to eliminate the old way of doing business—e.g., by eliminating the forms and procedures associated with the old way.
- The new practice had to be ultimately expanded to its fullest logical extent, or else it continued to be regarded as a "special project," which precluded it from becoming a standard practice.
- The time lags for achieving the various passages and cycles were different, so that it was important to get an early start on certain activities—e.g., establishing the personnel classifications for any new job skills that may be required by the new practice—to insure later routinization.

The findings were also analyzed in relation to the specific factors hypothesized to facilitate routinization (Chapter VII). The development of support for the innovation by an active innovator, by service practitioners, and by administrators, as well as the establishment of a core application and minimal competition among applications, appear to be important to routinization; in contrast, external assistance—whether in the form of federal (or state) funds or technical assistance—was found unrelated to routinization. Lastly, the implications of the study for further public policy research are discussed in Chapter VIII.

Chapter II

THE INNOVATIONS

A. GENERAL CHARACTERISTICS OF INNOVATIONS

Studying Life Histories of Innovations

There are two ways of recording life histories of specific innovations. One way is to select relevant innovations now being adopted by local agencies, with life histories based on the subsequent events that occur for each innovation. The study would then follow a *true longitudinal research design*, tracing the changes that occur at each site over the next several years (Kimberly, 1976a). Such a longitudinal design, however, entails heavy costs and great risks:

- A large number of innovations would have to be monitored at the outset, because the dropout rate would be unknown, and too small an initial sample could result in few innovations with extensive life histories.
- The study would have to be conducted over a long period of time because the routinization process, unlike adoption or implementation, is by definition a process that occurs over the course of many organizational events.
- The innovations to be studied would be somewhat unique because all would have begun during the same calendar period and the universe would actually form a special cohort from which the results of the study might not be easily generalized.

These problems pose sufficiently major barriers that a true longitudinal design appears unfeasible.

An alternative approach is to select innovations that have been adopted and implemented by local agencies some time in the past. A study would thus begin by identifying similar innovations that had been implemented at different sites on a periodic basis over a span of years. A quick spot-check could identify those innovations that had survived as well as those that had not. Appropriate life histories could then be reconstructed for a sample of these innovations. This approach would not wastefully commit resources to an unnecessarily large number of innovations, would capture some variation in outcomes, would produce results generalizable to more than one cohort, and would be less costly because old innovations could still be included, but not on a real-time basis. The research design would, however, not be a true longitudinal design, but would be a *post-hoc longitudinal design*, in which data collection occurs at a single point in time. In other words, changes that had occurred since the initial adoption would have to be traced by artifacts, documents, and the recall of human respondents (Kimberly, 1976a).

This alternative approach appears to be the most suitable for topics that of necessity cover events over a long period of time. An extensive study of the invention and development of notable technological inventions, for instance, followed

this design (IIT, 1968).[1] The study selected several major new technologies—e.g., magnetic ferrites, the videotape recorder, and oral contraceptives—and established for each innovation a series of key developmental events that had occurred. In some cases, the TRACES—as the study methodology became known—covered a period of 100 years or more. The research design differed from that proposed here, however, in that the study only focused on famous technologies that had been successfully developed and marketed; no histories were collected of technologies that had failed (by whatever criterion).

For the present study of routinization, the use of this post-hoc longitudinal design required a listing of innovations previously adopted by local agencies. To create some pragmatic and realistic boundaries for such a list, it was decided to develop the list from previous studies of innovation adoptions; the studies were limited to those on technological innovations,[2] those published since 1962, and those that covered any of three local services—public education, police protection, and fire protection. In other words, although there have been numerous innovations in local agencies, our universe was defined by what previous studies had already documented, rather than by a new survey addressed directly to local agencies. This choice was made because it was well known that previous studies had already identified large numbers of innovations adopted by local agencies.[3]

The Shifting Nature of Innovations

Because this study of routinization was based on life histories of specific innovations, there were several issues to be resolved concerning the final selection of innovations. Until recently, research was dominated by the seemingly straightforward assumption that "an innovation"[4] existed in some clearly recognizable form that corresponded to the theoretical conception adhered to by the researcher. Inherent in this assumption was the implication that the innovation as employed by one adopter was essentially the same as that used by all other adopters.

The assumption appeared to be a justifiable one, especially in cases where new practices had been adopted by individual (as opposed to organizational) users. It was reasonable to assume that a farmer would recognize a particular farm practice by name and that he could cite the year he first adopted it. The same could be expected when one tried either to trace the rate of adoption of a certain birth control method or to identify schools that were among the first to teach particular subjects that had not been part of the traditional curriculum. In either case it was expected that, upon hearing the name attached to the innovation (e.g., birth control pills; the new math), the adopter could easily say whether the practice was in use and, if in use, when it had begun.

[1] A second study (Battelle-Columbus Laboratories, 1973) also used the same method and was based in part on the original TRACES data.

[2] See the following subsections for a discussion and definition.

[3] For example, the literature consists of studies that have frequently involved national surveys of the adoption patterns for specific innovations.

[4] The term "innovation" is commonly used in three different ways (see Zaltman et al., 1973). In one context, it is synonomous with invention. Here, innovation is akin to the act of perceiving or creating something new. In another context, it is ascribed to a particular kind of organizational process as in Mohr's (1969) definition of an innovation as "the successful introduction into an applied situation of means or ends that are new to that situation" (see also Myers and Marquis, 1969). In a third context, which is the one employed in this paper, the innovation is an artifact of some sort that is newly introduced into an organization (see also Yin, Heald, and Vogel, 1977).

In recent years, however, as studies of innovations have broadened, there have been sharp challenges to the notion that "the innovation" is a clearly identifiable entity that varies little across adopting individuals and organizations (e.g., Warner, 1974).[5] The assaults on the conception of the innovation as a static entity have been especially prevalent in research concerned with innovations in organizational settings. As researchers have examined the implementation of innovations in organizational settings, they have found that the innovation as implemented can be quite different from the one originally planned for study. Moreover, it has become increasingly apparent that what was supposedly identified as the same innovation may vary substantially from site to site.

The work of Berman and McLaughlin (1974) readily demonstrates this phenomenon (see also McLaughlin, 1975). In their study, they found that the introduction of an educational innovation was often followed by a period of *mutual adaptation*. This was a period in which both the organization and the innovation underwent change; the organization adjusted to the presence of the innovation, and the innovation was simultaneously modified to suit its organizational environment. Thus, an observer returning to an organization several years after the introduction of an innovation could find that many aspects of the innovation were different from the innovation as first adopted. These findings were similar to those reported by Charters and Pellegrin (1973), who set out to observe the course of events for an educational innovation known as "differentiated staffing." Instead of finding that there was a consistent formulation of the innovation, they found that "there was no 'it' to select, implement, [or] evaluate. In fact, the very task of the so-called 'initiation period' was to define what the innovation—the blueprint—was to be." It is encouraging, therefore, to find that recent work in the innovation field has been careful to emphasize that innovations do, in fact, vary widely across sites and over time.

Such research also indicates the necessity of carefully considering the nature of the innovations to be selected for any study of routinization. Routinization is an organizational process that occurs over a long period of time in different organizations. During such a process, a wide range of changes is likely to occur in an innovation, making empirical study more difficult. As a result, the selection of innovations for study was based on two sets of criteria: (1) some common features for all the innovations included in the study, and (2) some variable features along which the innovations selected for study were deliberately varied.

Common Features of the Innovations Studied

All the innovations included in the study had four attributes: technological, historical, service, and behavioral emphases.

Technological Emphasis. For the purpose of study, technological innovations have been defined as innovations whose day-to-day operation relies on machines, equipment, computer hardware, or other apparatus. These are the technological artifacts of the innovation. This definition of a technological innovation excluded certain analytic techniques and processes (e.g., operations research

[5] Everett Rogers, who conducted many of the earlier studies on individual adoption, has given new attention to the instability of innovations by noting that a process of "re-invention" often occurs from site to site.

models or specific software for computer simulation models) that are often considered as technological in nature.[6]

The decision to limit this inquiry to innovations with a material component reflected a basic assumption that, when first inquiring into a complex organizational process such as routinization, it is necessary to begin with as concrete an innovation as possible. Thus, a definite advantage of limiting innovations to those with material artifacts is to assure that there will be something tangible to focus on when trying to trace the agency's experience with an innovation. A disadvantage, however, is that it is not possible to generalize the findings to those innovations that are without material components. This, of course, does not mean that the findings cannot be informative with respect to such innovations, but any statements about the routinization of innovations other than those having material artifacts will necessarily be tentative.

Historical Emphasis. To be included in this study, the material artifacts necessary for the operation of the innovation must have been adopted by a local agency after 1960. This restricted the study to those innovations that had generally come into use in the last 15 years. It eliminated from consideration such older innovations as the overhead projector or the police car (or even gasoline-driven fire trucks), whose initial adoption occurred in an era when local service agencies were organizationally and politically very different from the present time. Moreover, because the study covers the more contemporary period of the last 15 years, it includes many innovations whose development or initial use by local agencies was prompted by the availability of federal funds or other federal resources such as information dissemination efforts. This historical context thus forms an appropriate policy context for the study.

Service Emphasis. All the innovations in the study were service-oriented in function—i.e, they currently are, or in the past have been, used by practitioners in a local agency to assist in the delivery of agency-specific services. Thus, schools have the explicit mandate to instruct students in a variety of subjects. Similarly, police are responsible for maintaining law and order. These service functions may be contrasted to administrative functions such as budgeting, payroll, billing, etc., that only indirectly relate to an agency's mission. Some innovations may be used for both service and administrative functions, and these innovations were therefore eligible to become subjects of study. However, innovations dealing solely with the administrative operations of an agency were excluded from consideration.

Behavioral Emphasis. All the innovations had some behavioral component—i.e., their day-to-day operation relied on frequent and continuing direct or indirect interaction between practitioners in the service agency and the technology. Direct interaction refers to physical manipulation of the material artifacts. Indirect interaction refers to: (a) providing verbal instructions to an individual on how to manipulate the technology, or (b) processing output produced by or communications received through the material artifacts.

This attribute excluded those innovations in which the adopting unit may have been a local agency, but in which there was little behavioral involvement (e.g.,

[6] For example, Schon (1967) speaks of technology as "any tool or technique, any product or process, any physical equipment or method of doing or making, by which human capability is extended." Leavitt (1965) offers a similarly broad perspective when he describes technology as "direct problem solving inventions." Leavitt includes sets of activities, methods, or processes and layouts, arrangements, or patterns in his definition, as well as equipment, machines, and tools.

windowless schools, a new boiler system for heating firehouses, or new solid-state circuitry for communications equipment). Restricting the selection of innovations in this way assured that the innovations to be studied were those most likely to involve some of the most difficult problems in routinizing an innovation.

Variations in the Innovations Studied

At the same time, the innovations studied varied along certain dimensions. This allowed the study to test certain propositions about the possible effect of innovation characteristics on the routinization process. What became apparent during the pilot study phase of this study[7] was that the life history of an innovation was largely influenced by the breadth and nature of its functional applications. In other words, innovations can be placed into one of three classes, depending on the nature of the functional flexibility made possible by the technology. Once the innovations are so divided, the routinization fate of the innovations in one class appears to be explained by a different set of factors than those factors influencing the extent of routinization in the other two classes.[8] Furthermore, the distinction among the three classes appeared more important than those innovation attributes (e.g., compatibility, communicability, or simplicity—see Rogers, 1962; and Rothman, 1974) typically associated with the initial act of adoption.

The pilot study suggested two criteria for sorting innovations into the three classes reflecting functional flexibility. The first criterion distinguished *task-specific* from *task-diverse* innovations. An innovation is task-diverse if it is possible to use the hardware for at least two service applications. In general, the distinction between task-diverse and task-specific is made on the basis of the inherent nature of the innovation, independent of how it is used at any given site. Thus, one would expect task-diverse innovations to be used in a somewhat different manner from site to site, whereas task-specific innovations would only vary little from site to site.

The second criterion distinguished task-diverse innovations whose applications are distinctly *service-limited* from task-diverse innovations that have *both service and administrative applications*. As pointed out earlier, these administrative functions include budgeting, payroll, maintenance of personnel records, etc. An important hypothesis to be examined was that innovations with both service and administrative functions have unique routinization patterns, setting them apart from those innovations that only have service applications.

Table 3 lists a set of innovations according to these three classes. Routinization is hypothesized to occur for different reasons, depending upon which of the three classes an innovation falls within. (This is not to say that many factors will not also remain constantly important across all the three classes.)

Task-Specific Innovations. For these innovations, several conditions are hypothesized to promote the routinization of the innovation:

- *Widespread practitioner acceptance*, based on the ease of substitution for an older, core practice and on a practitioner's self-interest in innovation benefits.

[7] For a full description of the pilot work, see an unpublished paper available from the author: R. K. Yin et al., "Routinization III: Research Methods for Phase II," The Rand Corporation, January 1977.

[8] This is not the same as saying that one class of innovations will tend to become more routinized than another—which is not hypothesized to be the case.

Table 3

Technological Innovations Classified into Three Groups, According to Functional Flexibility

Service	Task-Specific Innovations	Task-Diverse Innovations	
		Service-Only	Service and Administration
Fire Protection	• Helmet with radio receiver and transmitter capability (In-helmet communications) • Jet-Axe • Automatic device for changing water pressure in fire hose (automated nozzle)	• Emergency medical vehicles • Light, versatile vehicles for extinguishing small fires (minipumpers)	
Police Protection	• Lightweight, bullet-proof vests (body armor) • Breath testing machines	• Minicomputers • Videotape recorders	• Police computers
Education	• Language laboratories • Hand-held calculators	• Educational television/ closed circuit television • Videotape recorders	• Computer-assisted instruction • Video systems that provide upstream and downstream video signals (two-way television)

- *Service payoffs*, namely cost savings or some other clearly visible and measurable advantage over a previous practice.
- *Minimal retraining* needed for practitioners.

These conditions stem directly from the nature of task-specific innovations. Such innovations are usually adopted by an agency to perform a narrowly defined task that represents some clear improvement over previous practice. Moreover, there is usually an explicitly defined way of using the innovation—a set of rules that can be followed to achieve a specified objective. The automated fire nozzle is an example. It is intended to permit firefighters to adjust the intensity of the water stream, thus (in theory) eliminating the need for a man to be stationed at the pumper to adjust the water intensity manually. There is a clearly specified and simple technique for using the nozzle, and once this technique has been practiced during training sessions at the fire academy, firefighters can proceed to apply the nozzle to fight fires exactly as they had with the traditional system.[9]

Practitioner satisfaction with the innovation appears to be an important determinant of whether or not the innovation will be routinized. (In some cases, as with lightweight body armor in police departments, practitioner satisfaction as a result of nonofficial trials can even lead to pressure on management to adopt an innovation.) Practitioner opposition is likely if the practitioners do not perceive that the innovation serves their interests or if there are problems in the innovation's initial use, thus making it difficult for practitioners to substitute the innovation for an established practice.

Task-Diverse (Service-Only) Innovations. In contrast, the factors that are hypothesized to enhance the routinization of these innovations are:

- *Support from agency administrators.*
- *Many complementary, service-related applications* (though not necessarily a clear service payoff).
- *Support from some core group of practitioners*, who may even require substantial training in the use of the innovation.

Task-diverse innovations are often brought to an agency either to perform a function that was not previously included in the agency's services or to supplement a previously established function. New jobs are frequently created in connection with the innovation, and practitioners may require extensive in-service training.

Moreover, if the innovation fails to work in the context of the original application that spurred its introduction, the equipment may be used for other applications as long as there is support from those in management who have the ultimate control over budget and personnel decisions. Thus, the flexibility in service applications increases the likelihood of some practitioner support because different practitioner groups will become involved for different applications. For instance, if educational television (ETV) does not succeed with the English teachers who were the first intended users, it may be possible to build constituency among mathematics teachers that support ETV even though they were not involved when it was first introduced. Of course, the ideal situation for assuring that ETV has continued use

[9] It is again important to point out that the significant characteristics are those inherent in the innovation, and not those that may have emerged during implementation at a particular site. The actual implementation experience may reveal many unforeseen problems.

in a school would be for its application to extend across many subjects—English, mathematics, science, language, etc.—and across many activities such as drama productions, sports events, and special events.

Whereas practitioner support for task-specific innovations is closely tied to the ease with which the innovation can be substituted for an existing practice, practitioner support for task-diverse innovations may well be influenced by two other factors. One of these appears to be the opportunity for practitioners to influence the early decisions on applications and equipment design. For example, in emergency medical vehicles, paramedics may take great pride in the fact that they have had a chance to help design the vehicle's internal layout.

The other factor hypothesized to influence sustained and growing practitioner support for task-diverse applications is the practitioner perception that the quality of service delivery has been enhanced. However, unlike the case with task-specific innovations, in which it is typically possible to point to "objective" or "documentable" evidence of innovation advantages, the evidence in favor of continued use of task-diverse innovations may often tend to be more "subjective" and "anecdotal." Thus, with computer-assisted instruction (CAI), enthusiastic teachers may claim that anyone can see that students with motivational problems improve their behavior when they have the opportunity to use the computer.

Task-Diverse (Service and Administrative) Innovations. Routinization for the innovations is hypothesized to be facilitated by several conditions within an agency—in addition to the conditions facilitating task-diverse (service-only) innovations:

- *A single, active innovator* dedicated to maintaining service functions.
- *Continued opportunities for practitioner training* in relation to service functions.
- *Minimal competition between administrative and service applications.*

Each of these conditions places emphasis on maintaining support for the service function, which may compete strongly with the administrative applications.

It is noteworthy that any savings or improvements that result from administrative applications of new technology may be easier to document objectively than those resulting from service applications. Thus, a school administrator can claim that a new computer system can "... now run the payroll in 50 minutes, where it used to take 6 people working 3 days to do the same thing. I don't know if we could ever go back to doing it the old way." In a budget review situation, such claims might be accepted as more persuasive evidence for continuing to use the computer for payroll than the diffuse claim that "the problem kids become more motivated" would be for continuing to use the computer for instruction.

In addition, growth in administrative functions is likely to threaten the service functions if a situation arises where tradeoffs must be made between the two. In such situations, the routinization of the service applications is hypothesized to occur more readily if there has been a respected middle-level manager or coordinator who has actively worked to maintain such applications. This person will typically have foreseen potential conflicts between the administrative and service applications, and may have taken several steps (e.g., making service applications known to the public) to assure that they are not discontinued. Another condition that helps secure the service applications is the availability of ongoing training opportunities for practitioners, which provides a mechanism for generating practitioner support.

B. SIX INNOVATIONS

From the array of innovations identified in searching the literature and during the pilot study phase, six innovations were selected for inclusion in the study (see Table 4). Several factors influenced the selection:

- The availability of information that identified a sufficient number of sites where the innovation had been adopted.
- Representation, if possible, of three different service areas (police, fire, and education).
- A spread of the innovations per service between the task-specific and task-diverse types.

The reason that six innovations were selected as an appropriate minimum number to be studied was to assure that at least two types of innovations would be included within each flexibility class. The following subsections contain brief descriptions of each type of innovation.

Table 4

Six Innovations Selected for this Study

Type of Urban Service	Functional Flexibility Class
Computer-assisted instruction (education)	Task-diverse (service and administrative)
Police computer systems (police)	Task-diverse (service and administrative)
Mobile intensive care units (fire)	Task-diverse (service only)
Closed circuit television (education)	Task-diverse (service only)
Breath testing (police)	Task-specific
Jet-Axe (fire)	Task-specific

Computer-Assisted Instruction

Advances in computer technology have been responsible for the gradual installation of computer educational systems across the country. In general, school districts have adopted computers to perform both *administrative* and well as *instructional* functions. The latter have been referred to as computer-assisted instruction (CAI), and CAI applications received their major impetus following the development of computer time-sharing systems. In such systems, many terminals can be served by the same computer, and a student working at a terminal can follow an instructional routine that is individually tailored to his or her needs.

In most schools, CAI consists of several terminals linked to a central computer.

The terminals and leased telephone lines may be paid from an individual school's budget, whereas the central facility is usually part of a school district's central administrative offices. The terminals are normally located in a classroom, so that several students (depending upon the number of terminals) may work at the terminals while other students follow the more traditional teaching methods. The students may rotate so that each is given an equal amount of terminal time, or a few students may be the dominant users. The terminals can be of two varieties—the older teletype terminals that tend to be noisy and slow but that operate reliably and provide a hardcopy printout, or the newer cathode ray terminals (CRTs) that are quiet and fast but are more expensive and cannot provide hardcopy without a companion printer.

The students may use the terminals for different educational purposes. In some cases, a computer science course is the subject of study, and the students have enrolled in the elective subject to learn how to do programming and use a computer. Such a course is not usually a part of the core curriculum, however, and may be cancelled if the school budget is tight. In other cases, students in mathematics classes learn to use a terminal (but not necessarily to program) so that they can solve mathematics problems with the computer's assistance. Finally, there are a number of software packages that allow students to practice solving mathematics problems; to learn materials in science, reading, social studies, language; or even to receive job counseling by following a preprogrammed curriculum. A frequent application is a drill-and-practice routine, in which the student does not do any programming but merely follows the simple directions given by the terminal.

CAI applications have usually been installed or developed as an adjunct to administrative computer applications. According to a recent survey, the majority of school computers (54 percent) are used for administrative purposes only; 38 percent are devoted to instructional and administrative purposes, and only 8 percent are used exclusively for instructional purposes (Bukoski and Korotkin, 1975 and 1976). (These proportions have not changed much during the last five years, if such results are compared with those from an earlier survey—Darby et al., 1970.) Administrative applications include the business management functions that might be found in any public agency (e.g., payroll, inventory, personnel, and accounts), as well as school-related applications that are nevertheless not CAI (e.g., student scheduling, maintenance of student records, transportation scheduling, and testing and evaluation).[10] Additional school-related functions cover some of the special functions of schools, such as processing library information or providing vocational guidance. (For a description of counseling services, see Ellis and Tiedeman, 1970.)

Early interest in CAI was facilitated by federal monies from the National Science Foundation. The federally sponsored activities included such demonstration projects as the PLATO system that began operating in 1959[11] at the University of Illinois (House, 1974) and the research on CAI conducted at Stanford University beginning in 1963-64 (Suppes and Morningstar, 1970). In recent years, the use of CAI has received support through federal grants under the Elementary and Secondary Education Act of 1965 (Title III), but it should also be pointed out that the

[10] For discussions of the various applications, including CAI, see Holtzman, 1970; and Salisbury, 1971.

[11] The PLATO I system did not have any time-sharing capability, and only the subsequent PLATO II, III, and IV systems were able to service more than one terminal at a time (see Bitzer and Skaperdas, 1970; and Watson, 1972).

vast majority of school computer systems have been totally supported with local funds (Bukoski and Korotkin, 1975).

Early applications of CAI were largely based on the assumption that it could provide individualized instruction at low cost. However, the rhetoric that developed in the early years around the promise of CAI (e.g., Atkinson and Wilson, 1968; and Margolin and Misch, 1970) has had unfortunate effects. First, many of the promises have not been fulfilled, which has added to the skepticism about the potential payoffs from educational innovations. Second, the early rhetoric served to antagonize teachers, who felt that CAI was a long-term threat to their jobs. Today some form of CAI is used in only about half of the country's public secondary schools: The median number of terminals is two per school (Bukoski and Korotkin, 1975 and 1976). Moreover, there have been no clear payoffs from CAI in terms of student achievement. Although there has been no nationwide evaluation of CAI, individual evaluations of specific systems (e.g., Oregon Board of Education, 1971; and Street, 1972) have had mixed results—i.e., CAI programs have not necessarily produced gains over non-CAI programs (see also Zinn, 1970; and Hunter et al., 1975). A frequent positive result has been that students from low-income families view CAI as a more equitable form of instruction than traditional classroom instruction; for example, the terminals allow a student to avoid interacting with teachers who might be perceived as discriminatory (Clark, 1973; and Beard, 1976).

A recent development in CAI has involved the installation of minicomputers in individual schools. Such minicomputers have usually been defined (e.g., Knight, 1975) in terms of their small storage capacity (€4 K bytes or less), low cost (less than $25,000 for the central processing unit), and compactness (less than 50 pounds for this unit with no special air conditioning required). The minicomputer can serve one or more terminals, and it allows an individual school to avoid the frequent problems of coordinating CAI use with either the central facility or other schools. Competition for terminal time, both within and among schools, appears to be a frequent problem. Bukoski and Korotkin (1975), in fact, noted in their survey that the "lack of terminals appears to be the single most frequently mentioned concern of school staffs currently using a computer to aid their instructional program." The minicomputer is one way of reducing such problems, especially where the central computer is mainly occupied with the administrative functions. At the same time, unless there is coordination among schools, each school then has to go through the same learning process in deciding which minicomputer to purchase and in maintaining and servicing the unit.

In summary, CAI is now used in many school systems. The main subjects involve mathematics and computer science, rather than English, the sciences, or social sciences. The CAI function is usually part of a larger computer operation that also provides administrative services to the school district. In most cases, there is direct competition between CAI and the business applications for computer time, and the CAI applications can be reduced to the point of disappearing as the computer continues to be used for administrative purposes. Most computer systems are supported totally by local funds, and the major apparent savings or increases in service have been associated with the administrative services, although there have been few formal evaluations of the actual nature of administrative improvements. Specific improvements in student achievement from CAI have not been consistently demonstrated, and the use of CAI has most commonly been justified on the

grounds that exposure to the computer is a valid goal in itself, independent of any instructional gains, simply because computers are so prevalent in American society that a student who has had such exposure will be better prepared to cope as an adult.

Police Computer Systems

Computer use by urban police departments has also been a major innovation of the last two decades.[12] Although such use was virtually unknown 20 years ago, almost all large departments located in cities of 500,000 population or over now employ some type of computer; for cities of 100,000 to 500,000 population, about 70 percent of the police departments use a computer (Colton, 1974). The increased use has resulted from at least four factors. First, the rising incidence of crimes and broadened police activity have led to enormous increases in recordkeeping requirements. Second, the development of national information systems (e.g., the FBI's National Crime Information Center in 1967), as well as the continued need to make the Uniform Crime Reports every month, have increased the incentives for establishing a computer operation. With such an operation, a police department can, for example, consult the records that the FBI maintains on offenders, thereby increasing the information available at the local level. Third, advances in computer technology, especially in the use of on-line systems, have expanded the potential applications for police use.[13] For instance, an officer on the street can have immediate access to records concerning the existence of a warrant on a suspected offender. This is done by communicating with a dispatcher, who operates an on-line terminal. Fourth, large amounts of federal funds have been made available by the U.S. Law Enforcement Assistance Administration (LEAA) (following the Safe Streets Act of 1968) for purchasing and developing hardware systems (Colton, 1972a).

Police departments can use a computer system for a variety of important functions (e.g., see Fyke, 1971). These include the everyday administrative applications related to the operation of any public agency—e.g., payroll, accounts, personnel, and property inventory. They also include an increasing number of applications specifically related to the operation of a police department—e.g., crime reporting; issuance of traffic citations; maintenance of records of outstanding warrants, stolen property, and criminal histories; and patrol allocation and dispatching. Some of these latter applications involve large amounts of data (e.g., criminal histories) or complex systems (e.g., computer-assisted dispatch), in which the full implementation of the application may take years.

Although a police department may now have integrated numerous applications into its computer system, only a few applications may have been added at any time. Typically, the earliest applications tend to involve traffic citations and crime reporting, neither of which require on-line access to the computer; subsequent applications cover the links to regional and national information systems and police management and patrol; only in later years will the computer system be extended to such complex functions as case reporting and computer-assisted dispatch (Colton, 1972a and 1974). Moreover, the increases in computer applications will also typically follow turnover in computer equipment. For instance, many police departments

[12] For a brief history, see Whisenand and Tamaru (1970).

[13] The first police on-line system was installed in St. Louis in 1964.

have gone through the three generations of core computers typified by the IBM 1401, 360, and 370 systems.

The variety and complexity of applications can create a constant competition for computer time. The ensuing scheduling difficulties may be especially aggravated by periods in which the computer is not functioning properly (downtime). Not surprisingly, the need to set priorities and establish the most efficient pattern of computer use has been continually cited as the most important computer problem (Colton, 1974). In most cities, this problem is compounded because the police department may be only one of several users of a municipal data processing operation. In such cases, the police department does not itself own or manage the core computer system. To the extent that the municipal data processing operations have organizational problems, all users, including the police department, will be adversely affected (Bingham, 1976). However, the coordination problems with a municipal data processing operation are not necessarily greater than the problems that arise when a police department manages its own computer system, so that no clear advantage has been found between the arrangements (Colton, 1972a). For instance, having sole ownership may be too costly and require too many technical skills not available in a department (Whisenand and Tamaru, 1970). One new trend has been for police departments to install their own minicomputers[14] that mainly perform message switching and that are linked with the municipal data processing operation. The advantages of this arrangement have not been fully determined and are not likely to be known for some time.

In contrast to other computer operations such as CAI, the service payoffs from police systems may be readily enumerated. A more efficient traffic citation system, for instance, can have the specific effect of increasing revenues from violations. On-line access to police and court records can result in a higher rate of arrests and an increase in a police officer's workload. Similarly, computer-assisted dispatch systems can be evaluated in terms of changes in the quality of police response and the duration of response time. However, in spite of the specificity and magnitude of these potential payoffs, there have been few attempts to evaluate existing computer systems along these lines. In part, this has been because of the weak tradition of evaluation research within local departments. However, it has also been because the diversity of police applications from site to site has discouraged national evaluations. Unfortunately, greater attention for evaluating computer systems has been given to municipal and regional computer systems than to the experiences of line agencies such as police departments (e.g., Hearle and Mason, 1963; Kraemer et al., 1976; and Eveland, Rogers, and Klepper, 1976). The diversity of the larger systems has made assessment difficult and has potentially led to incorrect inferences about the lack of service benefits in line agencies.[15] Whatever the other differences and similarities, police computer systems share an important attribute with most other administrative computer systems: There is little awareness or knowledge of the system by the urban residents who might be considered as the "clients" of police services. In this respect, police computer systems do not have the same level of visibility as, say, CAI in school districts.

[14] See the CAI discussion for a definition of minicomputers.

[15] This excessive variation in organizational arrangements may have been one reason that Eveland, Rogers, and Klepper (1976) found it difficult to discern any clear pattern of experiences in their study of regional computer systems.

For the purposes of the present study, police computer systems were considered as the primary innovation regardless of the number or type of applications developed by the system. This definition thus differs from CAI, in which the innovation was defined as having one or more instructional applications, regardless of the business and other uses of the school computer. Furthermore, because our study focused on organizational changes within a line agency such as a police or fire department or a school district, the universe of police innovations was limited to those instances in which the police department owned and operated the computer system (whether it was a large system or a minicomputer).[16] Without such a restriction, our study would have been diverted by the variety of organizational arrangements that characterize municipal computer operations, and the relevant institutional forces would not have dominantly involved any single user such as a police department.

Mobile Intensive Care Units

A mobile intensive care unit (MICU) provides emergency care away from a hospital facility. The unit consists of a specially equipped vehicle and a paramedic team that can administer a range of medical care upon instruction from a centrally located physician. The key technological element of this innovation is thus the communication capability of the MICU; the mobile staff can maintain voice contact with a physician, and physiological data about the patient's condition can be sent to the physician via radio telemetry (e.g., Lewis et al., 1972; and Hirschman et al., 1974). As such, the MICU goes much beyond either the traditional ambulance service (which provides transport service only) or the traditional first-aid provided by fire or police officers (which is limited to basic first-aid and is not based on immediate physiological measurements or advice from a physician.)

The MICU has another distinctive feature—the use of specially trained paramedic personnel. These personnel receive extensive training (i.e., several hundred hours by medical doctors and nurses) and may be alternatively referred to as paramedics, advanced emergency medical technicians (advanced EMTs), or firemedics. These paramedics can perform a variety of medically sophisticated tasks: e.g., cardiac defibrillation, intravenous therapy, electrocardiographic (ECG) telemetry, drug administration, and endotracheal intubation (Page, 1976). The paramedic personnel should not be confused with less advanced technicians—usually referred to as EMT-Ambulance or EMT-A's. The latter are generally ambulance personnel who have received an 81-hour course in basic life-support, and they can perform such tasks as cardiopulmonary resuscitation, spinal injury management, splinting, hemorrhage control, and emergency childbirth. Nor should paramedics and MICUs be confused with mobile coronary care units, which were under experimentation several years ago and in which physicians and nurses, rather than paramedics, traveled as part of the unit (e.g., Grace and Chadbourn, 1969; and Pyo and Watts,

[16] With the restriction to police-owned and operated computer systems, there is always the possibility of unrepresentative findings, because the more common national experience has been where police departments have been users of municipal systems. However, existing research has shown that there is no consistent pattern of differences between police-owned and municipally owned systems, either in terms of the distribution of such systems or of the success of the computer operations for police use (Colton, 1972b). Furthermore, the major concern of our study is with change in organizational settings such as police departments, and not with any assessment of the use of computer technology.

1970). As one can imagine, the mobile coronary care units involved much higher personnel costs and were an inefficient use of physician time.[17]

The MICUs have primarily dealt with victims of heart attacks or other coronary disorders. ECG and blood pressure data are the main physiologic symptoms that are transmitted to a centrally located physician. Based on these data as well as the visual symptoms reported by the paramedics, the physician can recommend the appropriate steps to be taken by the paramedic team. The apparent need for such a service has been based on the common observation that the first few minutes and hours of care are the most critical for patients suffering from myocardial infarctions, and that with the traditional ambulance service, many patients died while en route to the hospital (Pantridge and Geddes, 1967). However, in spite of the focus on coronary disorders, the MICU is capable of fulfilling a variety of medical functions. For this reason, MICUs were regarded in our study as a functionally flexible innovation—but one that did not involve the built-in conflicts as between the administrative and instructional uses of school computer systems.

Although the MICU has some basic service features and flexibility, the most distinctive variations result from the fact that MICUs can be operated under a wide variety of organizational arrangements in any given jurisdiction. For instance, the MICU may be part of the fire department (see Smith, 1971; and Page, 1975), police department (see Murphy, 1973), local health department, or even some other emergency service organization. Furthermore, the service may be coordinated at a city level, a county level, or some other regional level. For less populated areas, a common expectation has been that regional arrangements would have greater payoffs (e.g., Renner, 1974), even though regional systems may be difficult to implement because they require new institutional arrangements among existing agencies.[18] Because our study focused on highly urbanized areas, however, all of our observations were made on MICUs operated by city agencies; in particular, our study was limited to those cases in which the municipal fire department had implemented and was operating the MICU service.

Whatever the organizational arrangement, a citizen usually summons the MICU by calling an emergency telephone number—often 911. If the dispatcher feels that it is appropriate, an MICU unit is sent, which may have been housed in a local fire station or in a hospital facility. In most cases, the vehicle is used as an MICU only, and after the patient is treated it can also transport him or her to the hospital; in some cases, however, the vehicle may be a specially equipped fire apparatus, and after treating the patient, the paramedic team will call an ambulance (often operated by a private contractor) to transport the patient to the hospital. Thus, the basic nature of the MICU innovation requires cooperation among two or more city agencies. For instance, an MICU operated by a fire department will almost certainly require technical assistance and training from the local health department, will involve cooperative arrangements with the local hospital's emergency room, and may often depend upon the 911 communications center operated

[17] See Hartley (1971) for a survey of emergency service practice, broadly defined. This survey covers all kinds of assistance, of which MICUs are but one type. Similarly, see National Highway Traffic Safety Administration (1976) for a bibliography on emergency services, broadly defined.

[18] A recent GAO report had as its main target the vulnerable nature of these regional systems (see Comptroller General, 1976). The report doubted that most regional systems would survive the period of federal or other external funding, as the regional systems had failed to develop access to local government revenues or cooperative relationships with local agencies.

by the police department. Similarly, an MICU operated by a local hospital may have to rely on dispatching messages that come through both the police and fire departments.

In most jurisdictions, MICU services have only been initiated during the last ten years. This growth has probably followed the development of efficient and portable physiological equipment, such as that used to transmit ECG and blood pressure information via radio telemetry.[19] In addition, many policy initiatives have come from the federal government during the last decade. This has included the National Highway Safety Act of 1966, which established state training and licensing requirements, and specified the standards for equipping, organizing, and operating MICU vehicles (see Gibson, 1977, for an excellent review of federal activities in this area). These requirements were to be implemented with only a modest sum of new grant monies; the main financial incentive was the threat to withhold national highway construction funds (this threat has apparently never been fulfilled, even though several states continue to be noncompliant—see Gibson, 1977). Other early federal initiatives included activities by the Department of Health, Education, and Welfare, mainly under the Regional Medical Programs. A specific federal mandate was created in 1973, when Congress passed the Emergency Medical Service Systems Act, which provided grants for regional systems (reauthorized in 1976). Regional systems have also been the focus of a major program financed by the Robert Wood Johnson Foundation (see Chaiken and Gladstone, 1974).

As with both CAI and police computer systems, there have been few specific evaluations of the service payoffs from MICUs. This has been unfortunate, because the obvious impression at any MICU site is that service payoffs have occurred and can easily be determined. The payoffs can include: lives saved (paramedics describe their life-saving experiences in almost religiously fervent terms), amount and type of treatment provided at the scene, and greater satisfaction by clients and practitioner personnel. The absence of evaluations, however, has led to confusion because the organizational payoffs (as in regional systems) have been unclear and are confused with the service payoffs.

The federal initiatives have been responsible for the widespread use of standardized training programs such as the 81-hour course designed by the Department of Transportation for emergency medical technicians—ambulance (EMT-A's). In addition, the initiatives have been responsible for the passage of state legislation with regard to these training programs, training for paramedics (advanced EMTs), and certification and update training procedures (Collins, 1974; and Plaas, 1974). Finally, the federal initiatives have led to the development of certain standards for MICU vehicles and equipment. Nevertheless, there has been considerable variety in the implementation experiences of different local jurisdictions (e.g., Page, 1975; Gunter, 1975; and Comptroller General, 1976). Some jurisdictions have never adopted MICUs or, like New York City (see Sullivan, 1977), are just beginning to do so. Other jurisdictions have indeed initiated such services, only to witness subsequent difficulties and service interruptions due to inter-agency problems. Overall, the active federal role has not led by any means to the uniform provision of MICU

[19] For instance, the TELECARE II apparatus performs these functions as well as defibrillation, is battery operated, and weighs 37 pounds.

services (Gibson, 1977), and the MICU thus serves as a good example for examining the routinization process.

Closed Circuit Television Systems

A closed-circuit television system (CCTV) is a dedicated system that provides programs for specified television receivers that are placed in specific locations. Unauthorized receivers cannot view any of the programs because the target television receivers are either connected by cable to a central transmitting source, or are equipped with special converters to receive and unscramble the over-the-air signals. The central source may be used to transmit live productions, videotape replays, or retransmissions of over-the-air broadcasts to the target receivers. A CCTV system is thus different from regular, over-the-air broadcasting in that the system is limited to a specific group of receivers (though these receivers may still also tune into regularly broadcast programs). The system has its own production facility (if only a videotape recorder to play videotapes), signal-sending or transmitting capacity, and transmission system (e.g., cable connections leased from the telephone company or microwave links using dedicated over-the-air frequencies).

CCTV can be used by a variety of public and private organizations, including school districts. For school districts, CCTV potentially offers considerable advantages over the educational use of regular over-the-air television. Schools and classrooms, of course, have increasingly used over-the-air television in the classroom. Programs such as "The Electric Company" are designed for both at-home and in-school viewing (see Yin, 1973; and Liebert, 1973), and a teacher may use a classroom television set to show such a program to the class. The use of over-the-air television, however, has major shortcomings that can only be overcome by CCTV. The advantages of CCTV include the following:

- Teachers are not limited to those programs that are being shown by commercial or public broadcasting stations; there can be access to special educational programs designed specifically for the needs of a class.
- Teachers are not limited to the specific schedules of over-the-air programming; the use of television can thus be tailored to the classroom schedule.
- CCTV systems can have a much larger number of channels, all dedicated for educational use. The entire school, offering a diverse array of subjects, can potentially generate the need for using these different channels at the same time.
- Students are not limited to a passive role but can learn about the production process and create their own television programs.

For these reasons, educational and communications policymakers have attempted to make it easier for school districts to develop CCTV systems. In 1963, the Federal Communications Commission (FCC) reserved the use of four channels for such CCTV systems in education. These four were for the construction of an Instructional Television Fixed Service (ITFS), which is a microwave system designed to serve a school district (or a set of neighboring districts). In 1972, the FCC again attempted to encourage educational uses by specifying that new cable television systems in the 100 largest television markets had to set aside one channel for educational use (see Booth, 1972; Borko, 1973; Baer, 1974; and Carpenter-Huffman,

Kletter, and Yin, 1974). Finally, the Office of Education, through its programs under Title III of the Elementary and Secondary Education Act of 1965, has supported the use of CCTV systems in different school districts.

In theory, CCTV offers a wide variety of service benefits to the classroom teacher. First, existing over-the-air programs can be videotaped or acquired as part of a videotape library. The program can then be shown repeatedly at different hours of the day, so that teachers can use the programs for different classes and at the most suitable times (e.g., WCET-TV, 1973). Second, the videotape library can include films and other software that are specially designed for educational use. A televised segment can therefore be a preprogrammed part of the curriculum for a specific subject. Third, teachers and students can produce their own programs. The production process in recent years has been technologically facilitated by the evolution of the "portapak," which is a small, battery-operated vidicon camera that can be easily carried to produce videotapes of indoor or outdoor activities (see Bretz, 1976).

A CCTV system can also be used under a variety of organizational arrangements. For instance, teachers can use the system in their classrooms; or a school's media center can be the location of television carrels where students can gain individualized instruction. Because CCTV systems can cover a variety of school subjects and organizational arrangements, we have regarded the innovation as a functionally flexible one for the purposes of our study. However, possibly because of the diverse applications, there have been few studies of the actual experiences or payoffs from CCTV. Some reports (e.g., Gebolys, 1974) are merely preliminary descriptions of systems that ultimately did not even become operational. Other reports (e.g., WCET-TV, 1973; and Smith and Cooper, 1974) give actual evaluative evidence that student achievement improved as a result of a CCTV system, but only cover a short period of time that does not allow the evaluation to rule out the effects of contaminating factors. Finally, there have been a few surveys of CCTV use throughout the country (e.g., Wigren et al., 1967; and Feinberg, 1976), but these surveys have only noted adoption rates and future intentions, and have not probed the nature of individual local experiences.

In general, it can be said that CCTV systems have not spread as rapidly as once might have been hoped, even though there have been continued advances in television technology that have produced several generations of new equipment. The major difficulties appear to be related to high front-end costs (Feinberg, 1976), the difficulties of organizing a sophisticated media program in which production can be carried out without technical flaws (American Association of School Librarians, 1975), the training of teachers to use CCTV in a creative manner, and the limited availability of high-quality films, videotapes, and software programs (Carpenter-Huffman, Kletter, and Yin, 1974). On this last point, it might be noted, for instance, that many of the early CCTV systems predated the development of special educational programs such as "Sesame Street" or "The Electric Company"; attractive television programs were thus especially scarce before the early 1970s.

As a whole, microwave, cable, and other closed-circuit systems have remained more experimental and less integrated into the educational program than the classroom use of over-the-air television (Wigren et al., 1967). In other words, the instructional uses of television have been dominated by individual classroom viewing of available programs rather than coordinated, district systems. CCTV never-

theless serves as a relevant innovation for the purposes of the present study. This is because of the inherent nature of the innovation. It is a complex innovation whose main applications are service-related and not administrative, and it is an innovation that must be adopted by a school district (or group of schools) and not merely adopted by an individual classroom teacher.

Breath Testing for Driver Safety

Local law enforcement agencies have recently implemented many improvements for testing and analyzing the amount of alcohol found in a person's breath. These improvements have been a response to both technological developments in breath testing—which can be conducted through processes involving gas chromatography, photometric colorimetry, or infrared photometry—as well as the continued rise in traffic accidents attributable to persons driving while intoxicated (DWI).[30]

The main breath testing instruments that have been adopted include the Breathalyzer, the Alco-Limiter, the Gas Chrometograph, and the Alcohol Screening Device. The most common breath-analyzing instrument has been the Breathalyzer, a machine that uses photometric colorimetry and that infers the blood alcohol concentration (BAC) of a person on the basis of a sample of the person's breath. The innovation, a model of equipment that has only had one generation, consists of a semi-automatic instrument about the size of a small typewriter. The subject, seated next to the Breathalyzer, blows into a tube attached to the instrument, and a sample of 55 ml. of breath is collected in a cylinder. A small piston then forces the sample out of the cylinder and through a 3 ml. solution. If there is any alcohol in the breath sample, this alcohol will react chemically with the solution, producing visible changes in the color of the solution. Such changes are automatically measured by the Breathalyzer, allowing an officer to read the BAC from a calibrated gauge. The BAC is marked on a special piece of graph paper and is submitted as evidence in court. The entire test takes about five minutes.

Before such breath analyzing instruments became available, law enforcement agencies typically had to collect a sample of a person's blood or urine for blood analysis by a laboratory. In comparison to breath testing, these older procedures were highly complex, costly, and inefficient (Hoffman, 1973). Thus, breath testing offers the following advantages over older procedures:

- Less discomfort and inconvenience for the person being tested.
- No need for medical personnel to be present during testing.
- A shorter period of time away from patrol duty by the arresting officer.
- No delay of several days between the administration of the test and the reporting of the laboratory results.
- No need to coordinate law enforcement procedures with those of a central laboratory. (The older procedures had to be careful to establish a direct chain of evidence to assure that none of the samples had been exchanged or had accidentally become contaminated.)

The use of the Breathalyzer (or any other instrument for breath analysis) to present evidence on BAC is based on two important assumptions. First, the amount

[30] According to one estimate, alcohol was involved in one-half of the 45,000 traffic fatalities in 1976. (See Dozier and Moulden, 1977.)

of alcohol detected in a person's *breath* is assumed to be related to his or her BAC. Second, the BAC is assumed to be related to behavioral impairment in driving a car. Research has gradually established the validity of the latter assumption, with a BAC of less than 0.05 percent now being regarded as evidence of no behavioral impairment, a BAC of 0.10 percent or more as presumptive evidence of impairment, and a BAC of between 0.05 and 0.10 percent as an equivocal range within which impairment may or may not exist. However, research has not yet definitively established the validity of the former assumption—that breath alcohol content is related to BAC. Two experts who reviewed the major studies on this latter topic concluded (Mason and Dubowski, 1974; see also Mason and Dubowski, 1976):

> The reliability of properly performed breath tests for the purpose of determining alcohol in breath is, indeed, adequate. It is the transmutation of a breath quantity to a blood concentration that is less than satisfactory. These considerations lead us to conclude that in actual law-enforcement practice, when a breath sample is analyzed for alcohol, the quantity found cannot be used to calculate the simultaneously existing actual blood alcohol concentration without making assumptions having uncertain validities in any given case because they have not been assessed.

Nevertheless, there have been no findings that actually challenge the link between breath alcohol content and *blood* alcohol concentration. Thus, the results of breath tests have been successfully used in court in conjunction with observations of an offender's motor behavior at the time of arrest, and in most jurisdictions the combined evidence has led to higher conviction rates for DWI cases.

Federal agencies have played an important role in the implementation of Breathalyzers and other breath testing equipment. The formation of the National Highway Traffic Safety Administration in 1966 led to the issuance of standards and regulations for breath testing. Thus, federal regulations now cover:

- The standards that should be applied to the operation and monitoring of breath testing equipment ("Standard for Devices To Measure Breath Alcohol," 1973).
- The certification of specific brands of equipment that meet those standards (*Federal Register*, 1976; see also Flores, 1975).
- Guidelines for state laws on: agreement to submit to blood alcohol tests (*implied consent* statutes), automatically presumed guilt for BAC levels of 0.10 percent and over (*illegal per se* statutes), and submission to roadside screening to make on-site determinations of whether a person's BAC appears high enough to justify the making of an arrest and the administration of a breath analysis test (*pre-arrest screening* statutes).[21]

The states have also been required to establish special agencies to deal with alcohol and traffic programs. As a result, most states have passed the appropriate statutes to regulate the use of breath testing equipment, although there are variations among states.[22]

[21] A person must be arrested on DWI charges before a breath test can be conducted. The pre-screening procedure facilitates a preliminary judgment on whether the arrest should be made, but only the results of the subsequent breath test are used as evidence in court. (See Moulden and Voas, 1975.)

[22] For instance, all states except Idaho and Utah have a presumptive 0.10 percent BAC law; in Idaho and Utah, the level has been set at 0.08 percent. Only a minority of the states, however, have passed pre-screening laws. (See Dozier and Moulden, 1977.)

It is important to note that, in spite of these federal and state initiatives, there is still substantial variation in the use of breath testing equipment by local law enforcement agencies. First, the agencies are by no means required to conduct breath tests. The major statutes cover issues concerning BAC (and not breath analysis levels), and the most definitive evidence can still only be derived by direct BAC tests (i.e., a blood analysis or urinalysis). The traditional methods for testing BAC, in other words, can still play an essential role for which breath testing has not become a total replacement. Second, the specific procedures for using breath testing equipment may vary. Some police departments have mobile units that transport the breath testing equipment to the scene of an arrest; other departments place such equipment in one or more precinct houses. Third, agencies vary in the degree to which they use videotapes as supplementary evidence. In some cases, an agency may videotape a series of motor tests but not the actual administration of the breath tests; in other cases, an agency may videotape both; in yet other agencies, there may be no videotapes used at all.

Jet-Axe

Jet-Axe is the trade name for a product that is manufactured and distributed across the country by a single company located in Fairfield, California. The device is an explosive unit that can be attached to a wall or door and then detonated from a remote location. The ensuing explosion creates a hole of about three feet in diameter, through which firefighters can either gain entry into a building or ventilate a fire. The device is entirely self-destructing; if another hole is needed for subsequent entry or ventilation, another Jet-Axe must be used and detonated.

The Jet Axe's development followed advances in space technology, with demonstrations for use by urban fire departments first taking place in 1968-69 (Frohman et al., 1972). The presumed need for the Jet-Axe in urban firefighting was based on estimates that one-third of the some 150,000 annual fires in urban areas required forcible entry, and that in 10 percent of these 50,000 cases, entry through traditional methods (e.g., using crowbars or conventional fire axes) required 20 minutes or longer (Frohman et al., 1972). With the Jet-Axe, entry can be created in a matter of minutes. The fire officer in charge at a fire determines whether a situation requires the use of a Jet-Axe and, if so, where it should be placed. A firefighter then hangs the Axe on a nail or magnetic hook so that it hangs vertically against the wall or door to be cut. A safety device is then removed from the Jet-Axe's container and a 35-foot firing line is laid out. When the line is fully extended and all nearby personnel are behind some protective barrier, the firefighter or fire officer will detonate the Jet-Axe with a spring-loaded firing pin.

There are several models of the Jet Axe, differing in size and amount of explosive force. However, there has been no updating or new generation of models. A fire department may purchase the Jet-Axes at a cost of about $125 each. Although this amount is small and can usually be paid out of a chief's discretionary budget, the fact that the device is entirely self-consuming precludes massive testing and demonstration at a fire academy for training purposes. Therefore, although many firefighters in a department are likely to receive oral instructions and may even view a film about the Jet-Axe's use, only a few in any given department will actually have had direct training with the device. This lack of exposure is compounded by the fact that only few firefighters will have opportunities to use the Jet-Axe in

firefighting. The tendency has been to apply the Jet-Axe only in cases where the conventional methods are likely to fail or are judged to require an inordinate amount of time or effort—e.g., in cutting through steel or corrugated iron steel doors, heavy-gauge metal screen, or industrial roofing. For any given fire department, the number of such fires is much smaller than those merely requiring forcible entry of any kind. Moreover, the Jet-Axe will not be used even in these situations if some person is still on the other side of the barrier because of the strong possibility of inflicting injury to that person. Thus, few firefighters actually gain direct experience with the Jet-Axe, either through training or firefighting opportunities.

Nevertheless, the Jet-Axe does provide a number of potential service payoffs: Some barriers that cannot be penetrated with conventional methods can be cleared by the Jet-Axe; the entry is often cleaner and creates minimal damage to surrounding walls or doors than conventional methods; and access and entry time is significantly reduced by using the Jet-Axe. Moreover, the physical effort in using conventional methods can often exhaust firefighters so that they are less capable of combatting a fire once they have gained entry through conventional methods, and the use of the Jet-Axe can minimize this problem.

In sum, the Jet-Axe is a reliable explosive device that was designed to penetrate particularly difficult physical barriers in fighting fires. The device comes in several sizes and has been on the market for about seven years. During this period, it has been purchased and used by many fire departments across the country.[23] The firefighting application followed extensive research and development related to space programs, as well as intensive demonstrations, before urban fire chiefs, during 1968-69.

C. SUMMARY

This chapter has described the six types of innovations whose life histories at specific sites were the subject of study: computer-assisted instruction, police computer systems, mobile intensive care units, closed circuit television systems, breath testing, and the Jet-Axe.

The six represent a conceptual distinction among task-specific, task-diverse (service-only), and task-diverse (service and administrative) classes of innovations. Each class has been hypothesized, on the basis of observations made during a pilot study phase, to become routinized for different reasons (a different set of factors were specified for each class of innovations).

The innovations to be studied were selected according to a post-hoc longitudinal research design. In this design, innovations known to have been adopted during the last 15 years were identified. For a sample of these innovations, the life histories from the time of adoption to the present will be traced in Chapters IV-VI. To facilitate the tracking of important organizational events, the six types of innovations were all selected because they had some technological artifact. This attribute made tracking easier because of the added concreteness of the innovation but may limit the conclusions of the study to "hardware" innovations.

[23] One preliminary estimate was that 400 Jet-Axes were sold during 1970-72 (Frohman et al., 1972).

Chapter III

PASSAGES AND CYCLES

The major lines of argument for thinking about routinization have thus far taken the following form. First, routinization represents the process by which new service practices become an integral part of urban bureaucracies; the evolution of such practices, it has been argued, has been poorly understood in the past but is an essential component of any future strategy for changing urban bureaucracies. Second, the routinization process can best be revealed if one traces the life histories of specific innovations. These innovations are new service practices and, if successful over time, can become a part of standard bureaucratic practice.

The discussion now turns to the most critical part of the conceptual framework: determining how to identify and assess the specific organizational changes that mark routinization. This chapter contributes an original conceptualization of organizational change that focuses on the notion of *passages* and *cycles*. This, however, is discussed in later portions of the chapter. First, the traditional approaches to the study of bureaucratic innovation need to be briefly reviewed.

Traditional Approaches for Studying Bureaucratic Innovation

Four general approaches have dominated traditional ways of thinking about bureaucratic innovation.[1] These approaches are fully reviewed in Appendix E, but in brief they are marked by the following characteristics:

- **Research, Development and Diffusion.** Emphasizes the macro-institutional environment in conducting R&D and in producing, marketing, and implementing new technologies; gives little attention to events within specific organizations that implement and routinize the new technologies.
- **Social Interaction.** Emphasizes the communication network and adoption pattern for specific innovations; individuals rather than organizations have been the main adopters studied, and the main focus has been the spread or diffusion among adopters rather than the events following adoption at a given site.
- **Innovative Organizations.** Correlates a wide range of organizational characteristics with the occurrence of bureaucratic innovation; typical result is a profile of innovative versus noninnovative organizations, but such a profile is cross-sectional in nature and cannot fully capture such processes as implementation or routinization, which take place over time within the same organization.
- **Organizational Change.** Examines events over time within the same organization; usually specifies a stage theory (e.g., adoption → implemen-

[1] Ronald Havelock (1969) has done an excellent job of reviewing the work for three of these approaches (all but the Innovative Organizations approach). He uses the label "problem-solving" in referring to the organizational change approach. This author has previously described these same approaches, but mainly in the context of problems of adoption and implementation, and not routinization. See Yin (1976) and Yin, Heald, and Vogel (1977).

tation → routinization), but few studies have specified a set of critical events or the operational characteristics of the innovation process.

In general, even though many revisions have occurred in these approaches, they still form the foundation for various empirical studies of local services and bureaucratic innovations. For studying routinization, only the Organizational Change approach provides even rudimentary assistance for analyzing life histories of innovations. Nevertheless, it is useful to show how recent empirical studies of local service innovation still tend to follow one or another approach. Each approach implies a different research design, and this in turn dictates the issues that a study can address.

Research, Development and Diffusion Approach—Radnor (1975) and Baer et al. (1976). These first two studies follow the R,D&D approach. The Radnor (1975) study examined the use of new equipment in the law-enforcement field, based on interviews of over 200 organizations, including users, producers, distributors, and related organizations. Thus, the study investigated the institutional relationships at each step in the development of new equipment, including: needs assessment, investment in and funding of the appropriate R&D, production, marketing, sales, and implementation feedback. The study attempted to identify the problems at each step, and thus to specify policies that could be followed by the federal government to alleviate these problems. However, no attempt was made to understand the life histories of innovations within specific organizations.

The Baer et al. (1976) study contained case studies of 24 federal demonstration projects, of which about 6 involved applications in local services (e.g., a mechanized system for collecting refuse, a computer-assisted electrocardiogram analysis, a dial-a-ride transportation system, and an expressway surveillance and control system). The study defined demonstration projects as representing "... the final stage of 'scaling up' from the laboratory to commercial use," and as a result of the case study analysis, six factors were identified as being associated with successful demonstrations:

- A technology well in hand;
- Cost and risk sharing with real participants;
- Project initiative from a nonfederal source;
- Existence of a strong industrial system for commercialization;
- Participation during the planning stage of all institutional elements needed for commercialization; and
- Absence of tight time constraints.

The Baer et al. study dealt with the relationships among various public and private institutions in producing and using a new technology and therefore illustrates the main strengths and weaknesses of the R,D&D approach. The approach is useful for identifying the various institutions involved in producing a new technology. However, at the point of adoption, implementation, or routinization, the R,D&D approach provides little guidance for analyzing the key organizational events within a given local agency.

Social Interaction Approach—Feller, Menzel, and Kozak (1976). This study was based on extensive surveys of agency officials in four services (traffic control, air pollution, firefighting, and solid waste). The officials identified new technologies used in each service and gave their reasons for adopting or not adopt-

ing the various technologies. A major finding of this study was that, in all but the solid waste area, there was an extensive pattern of diffusion, with 60 to 80 percent of the respondents indicating their agency had adopted such innovations as:

- Induction loop detectors;
- Solid state traffic-control devices;
- Optically programmed traffic signals;
- Lightweight fire hoses;
- Lightweight hose couplings; and
- Continuous SO_2 monitoring.

Many other innovations had been adopted by a large number of the agencies surveyed. The study thus challenged the traditional stereotypes of public services as comprised of noninnovative organizations. Reflecting the Social Interaction approach, the study further analyzed the pattern of diffusion. For instance, one finding was that there were no "innovative" cities in which the four services all tended to be innovative; another finding was that innovative attempts tended to be located in jurisdictions near the site of the relevant manufacturer. Feller, Menzel, and Kozak also attempted to conduct an analysis of the intra-organizational factors that characterized adoption behavior, but the results were inconclusive, suggesting only that individual adoptions were not to be explained by any model in which the magnitude of the problem (prior need or performance gap) or the availability of extra resources (slack resources) were the main components.

Although the Feller, Menzel, and Kozak study attempted to go beyond the Social Interaction approach by studying organizational characteristics, the main findings and contribution deal with the diffusion patterns of different technologies in local services. This contribution represents the inherent strengths and weaknesses of the Social Interaction approach. It is only this approach, for instance, that does an adequate job of analyzing diffusion patterns across agencies and sites over time (e.g., none of the other studies cited here contains a diffusion curve). At the same time, such a perspective yields little appreciation for organizational changes *within* an adopting agency.

Innovative Organizations—Bingham (1976), Nelson and Sieber (1976), and Danziger and Dutton (1976). These three studies fall within the Innovative Organizations approach, although the Bingham (1976) study also covers some diffusion and hence Social Interaction issues. The Bingham study examined the use of eight innovations in four services (public housing, public schools, public libraries, and general municipal government). The diffusion aspect of the study was based on the results of surveys of agencies in cities over 50,000, and it was found that there were no "innovative" cities (i.e., where there was a high degree of innovativeness in all four services in the same city).

The bulk of the Bingham study, however, dealt with the identification of factors correlated with the adoption of innovations. The main finding was that an agency's environment (e.g., existence of federal or state assistance, slack resources, and overall professionalism in local government) was one of the strong determinants of adoption behavior. Except for organizational size, whose role is statistically difficult to disentangle from that of community size and wealth, the study found no organizational characteristics that were correlated with adoption behavior. Two conceptual contributions by the study were that: (1) innovations in method (process inno-

vations) followed the predicted patterns more than innovations involving physical changes (product innovations); and (2) some agencies could and often did innovate to improve already adequate levels of performance (amenity condition), as well as to upgrade substandard performance (need condition). The latter finding may help to explain the failure to find, as in the Feller, Menzel, and Kozak (1976) study, a performance gap as one of the correlates of innovation.

The Nelson and Sieber (1976) study was based on a survey of school principals in cities over 300,000; the survey asked the respondents to indicate whether any of 17 innovations were in use or being tested. Most of the innovations were curriculum changes, and only a minority of them constituted technological innovations (e.g., televised instruction, teaching machines, and language laboratories). The analysis focused on the characteristics of the innovation as well as of the adopting agency as potential determinants of adoption. Among the findings, it was shown that the potential high cost of an innovation was not necessarily a barrier to its use; cost, however, was not related to the perceived quality of the innovation; and there was only a moderately negative relationship between administrative difficulties during implementation and subsequent use.

The Danziger and Dutton (1976) study followed almost the same research design as that of Nelson and Sieber: a survey of city and county governments for the extent of their use of electronic data processing innovations. Over 700 jurisdictions were surveyed; the responses by each jurisdiction were used to calculate an innovativeness score. Highly innovative jurisdictions were found to be: large in size with a complex governmental organization; in sites where there was professional-managerial control over electronic data processing (EDP) decisions; where there was not a highly developed industrial activity; and where control over EDP decisions was decentralized.

These three studies in the aggregate give an indication of the problems with the Innovative Organizations approach. Although each study was more than adequately designed and contained sophisticated single and multivariate analyses, the studies each defined a very different set of innovations and examined different organizational attributes. It is this variation that has led Downs and Mohr (1976) to question the ultimate utility of the Innovative Organizations approach; the results may always be idiosyncratic to the innovations chosen, characteristics examined, and measures used. Little convergence of findings from different studies can be expected.

Organizational Change Approach—Bale (1976) and Berman and McLaughlin (1977 and 1978). Both studies examined innovations in schools; Bale (1976) focused on the use of a single innovation—instructional use of the television program "The Electric Company"—and Berman and McLaughlin (1977 and 1978) examined a wide variety of federally instigated innovations, only some of which involved new technology.

The Bale (1976) study actually followed an innovative research design in which the investigator explicitly attempted to combine the Innovative Organizations and Organizational Change approaches. This was done by establishing several stages of change, and then examining the organizational characteristics that were important at each stage of change. Figure 1 summarizes the research design. It shows the stages of change and the organizational characteristics investigated, and it provides the results of the study. A typical finding was that pupil characteristics

Stages in Kaplan's Model of the Process of Organizational Change	Influencing Factors											
	Attributes of the Innovation	Strategies of Introduction	Characteristics of Organization Members	Structural Properties of Organization	Characteristics of Organizational Environment	Characteristics of Throughput (Pupils)	Results of Stage 1	Results of Stage 2	Results of Stage 3	Results of Stage 4	Results of Stage 5	Results of Stage 6
Stage 1: Essence of a problem condition			0	+	+	+						
Stage 2: Diagnosis	?	?	+	0	+	0	0					
Stage 3: Initiation	?	?	+	+	+	0	+	+				
Stage 4: Introduction	?	?	+	0	0	0	+	0	+			
Stage 5: Transition	?	?	0	+	0	0	0	+	+	0		
Stage 6: Routinization	?	?	?	?	?	?	?	?	?	?	?	
Stage 7: Stabilization	?	?	?	?	?	?	?	?	?	?	?	?

SOURCE: Richard L. Bale, "Organizational Change and Innovation in American Elementary Schools: The Case of 'The Electric Company,'" in Ph.D. dissertation, Florida State University, Department of Sociology, Tallahassee, May 1976.

NOTE: The hatch marks indicate cells that are illogical or redundant; for filled cells, + indicates factor had impact at that stage, 0 indicates factor had no impact at that stage, and ? indicates factor and/or stage not addressed by study.

Fig. 1—Summary of Bale's conceptual framework and findings

were an important correlate in the initial stage in determining whether a school should consider an innovation; at later stages, however, pupil characteristics—as one might readily expect—had little to do with successful diagnosis, initiation, introduction, and transition. The figure also indicates the limited scope of the Bale study; there was no attempt to define the later stages of change—routinization or stabilization—or to identify the correlates of these stages.

The Berman and McLaughlin (1977 and 1978) study covered a wide variety of innovations sponsored by the U.S. Office of Education. The key findings were that the innovations often differed unpredictably from site to site, and that this in part was the result of a process of mutual adaptation, whereby the innovation and the site both modified each other. Another key finding was that the overwhelming majority of the innovations failed to become incorporated—as measured by the transition from federal to local sources of funding. Because of this finding, however, the authors were unable to examine routinization in any detail.

These two studies illustrate the potential of the Organizational Change approach. Unlike the other three approaches, an explicit attempt is made to examine events over time within specific organizations. In theory, the full life history of an innovation—from adoption to routinization—can be traced. Unfortunately, most studies that follow the Organizational Change approach (including the Bale and Berman and McLaughlin studies) have failed to trace the full process. Adoption and implementation remain the primary focus because few innovations appear to become routinized. Moreover, most studies have still not provided operational guidelines to determine whether routinization has occurred. As a result, the next section attempts to develop a more comprehensive conceptual and operational framework.

Organizational Passages and Cycles as a Way of Defining Routinization

When an innovation has become a stable and regular part of organizational procedures and behavior, it is defined as having become routinized. In the local service setting, a routinized innovation would be part of the common services normally provided by an agency; the practice would no longer be regarded as a special innovation. For innovations that have replaced older service practices, complete routinization implies that the agency cannot revert back to the displaced service practice. However, the innovation may be replaced by some newer innovation at a later date.

The acceptance of this framework still leaves one far short of being able to analyze routinization because so many of the important concepts have not yet been made specific. We need to further define routinization, discuss the implications for routinization strategies, and then review various hypotheses about why routinization occurs. The existing literature on organizational change provides meager assistance for answering certain key questions:

- What are the characteristics of routinization?
- Is routinization an absolute condition or are there different degrees of routinization?
- How can the state of routinization be assessed through empirical study?

The main contribution of this study is to answer these questions, by establishing an initial set of categories and then by describing the events in specific life histories. Previous research has not covered these key questions adequately. For instance, although the stages of organizational change appear to be commonly accepted theoretical notions, even discussions that claim to assist in the design of field studies do not describe how such stages are to be assessed (e.g., Barnes, 1971). At another level of analysis, the research that deals with the birth, growth, and death of an organization (e.g., Downs, 1967; and Kaufman, 1971, 1975, and 1976) has primarily been concerned with organizational size as the main outcome measure.[2] None of these studies, however, has attempted to determine the changes occurring within an organization as a new practice becomes routinized.

Routinization must be assessed by focusing attention on discrete organizational conditions—i.e., documentable occurrences—such as the following:

- A new set of procedures exists in the police department's orders of the day.
- An agency is operating on a new fiscal year budget and management plan.
- A biology teacher has been replaced during the past year.
- Equipment has been obtained through a new leasing contract.
- A new reorganization plan has been implemented as organizational positions have been redefined.

These conditions are not necessarily simple; they can involve a series of decisions that are difficult to trace. Moreover, the conditions may not be easily defined in terms of the specific dates when the conditions first existed. The budget process, for instance, may take place over a multi-week period and still require modifications throughout the year. The important characteristics of such conditions, however, are: (1) that they are, in principle, sufficiently self-contained to serve as units of analysis, and (2) that they constitute, in the aggregate, a way of assessing the current status of an organization.

Any focus on organizational conditions immediately raises the same problem that nags all organizational change theories: the need to distinguish important conditions or changes from unimportant ones. Clearly, the daily life of an organization can consist of an almost infinite array of conditions:

- The manager was out because of illness.
- The paper in the Xerox machine was replaced.
- There was an office party.
- The supervisor wrote a reply to some employee suggestions.

How should conditions be defined so that only those that are relevant to routinization are assessed? What is needed is a set of categories of organizational conditions, in which each category reflects an important facet of routinization status. To the extent that routinization is considered as the normal occurrence of a specific practice that began as an innovation, these categories should cover the organizational resources or operations that sustain innovations over a period of time.

In a local service agency, an innovation may be sustained by five major resources: budgetary resources, personnel resources, training programs for service personnel, appropriate rules of organizational governance (e.g., a statute, regula-

[2] For an excellent review of studies using organizational size as a variable, see Kimberly, 1976b.

tion, or procedural manual), and supply and maintenance operations. In general, the innovation that has received the most sustained support from these resources may be regarded as being the most routinized. To gain support from these resources, an innovation must achieve a series of *passages* or *cycles*. These are the two critical concepts that will recur throughout this study.

A "passage" occurs when a formal transition from one organizational state to another has taken place. For instance, new job skills often require the establishment of specific personnel classifications in the civil service system. The actual establishment of such classifications would constitute a passage. Similarly, the establishment of a new component in an in-service training program, the issuance of a new entry in an agency's operating manual, or the change from an external to internal source of funding would also serve as passages. The term "passage," then, is used to define significant changes in organizational procedures or structure that reflect increased organizational support for an innovation. In most cases, such passages occur only once and mean that an innovation has become a more integral part of an organization. The more passages that have been achieved, the more routinized an innovation may be regarded—all other things being equal.

In contrast, *a "cycle" is an organizational event that occurs repeatedly during the lifetime of an organization.* Each time a cycle occurs, the use of an innovation may be questioned and threatened. However, the more cycles that an innovation survives, the more routinized it may be regarded (again, all other things being equal). The term "cycle" thus applies to repeated events that occur as part of an organization's operations and that may affect an innovation.

The routinization of an innovation may be described in terms of its ability to negotiate several passages as well as its ability to survive a period of organizational cycles. To further elaborate this concept of routinization, the following paragraphs identify the major passages and cycles related to the five types of resources needed to sustain an innovation:

- Budgetary resources.
- Personnel resources.
- Training programs for service personnel.
- Organizational governance.
- Supply and maintenance operations.

Budgetary Resources. The initial budgetary support for an innovation will evolve as a result of budgetary proposals, review, deliberation, and decisionmaking at different organizational levels (not all of which are within the target agency). A routinized innovation, however, is one that has survived numerous budgetary cycles. For most agencies, the cycle occurs annually. The more cycles that occur, the more the innovation would be considered routinized and the less it would be regarded as an innovation.

Within local service agencies, another important budgetary distinction arises because of the pervasive nature of federal funding at the local level. This is the distinction between budgetary items supported by local revenue (hard money) and those supported by externally derived sources, generally federal grants or aid (soft money). Because the soft money is typically time-limited (e.g., a project grant of three years' duration), an innovation is more routinized if it is supported by hard rather than by soft money. For an innovation that began with soft money, the

passage or transition to hard money may thus be regarded as a significant step toward routinization.[3]

Personnel Resources. Personnel resources are present in any innovation, whether they are used for operating, managing, or coordinating the use of the innovation. As with budgetary resources, the important components of the personnel resources in terms of the routinization process also involve passages and cycles. The resources include the jobs themselves as well as the incumbents. In local service agencies, job classifications should reflect job responsibilities and duties. For an innovation that began with a temporary or ad hoc definition of job functions (typically, the functions may have been defined by an outside consultant or equipment maufacturer), the passage or transition of such functions into civil service[4] classifications may be regarded as a significant step toward routinization. Similarly, the passage of the function into job prerequisites or promotional requirements would also be a significant step.

In spite of the fact that job functions are documented in this manner, each incumbent will nevertheless perform a specific job in a slightly idiosyncratic manner. The more routinized innovation is thus one whose personnel requirements have been carried out by more generations (or cycles) of incumbents (Hage and Aiken, 1970). Of course, turnover rates vary according to job and agency, so that it is impossible to relate such cycles of incumbents to any calendar period of time. However, it is generally true that the longer the period of time, the more personnel cycles will have occurred.

Such turnover is often difficult to measure. This is because high turnover rates are not desirable at the outset of an innovation's life history; yet, low turnover rates are not desirable when an innovation has matured, as this will tend to (undesirably) identify the innovation with a specific group of incumbents. Thus, turnover should occur during the later stages in the life history. In addition to bringing new incumbents into contact with the innovation, turnover may also mean the promotion of the original incumbents—presumably supportive of the innovation—to higher positions of authority in the agency. Such promotion will add further support for the innovation and is thus a desirable cycle of events.

Training Programs. Training requirements, particularly for practitioners, vary from innovation to innovation. Some innovations are easy to operate and require little instruction to be used; others require training that can last over many weeks. Thus, training resources, unlike budgetary and personnel resources, may not be required by every innovation. (The discussion only pertains to those that do.) Nevertheless, it will be seen that training again involves a passage and a cycle.

In local service agencies, the practitioners typically belong to a practice-oriented profession—e.g., teaching, medicine, law enforcement, and social work. The profession will set standards for practice, which may be incorporated into the curriculum of the professional school—e.g., police academies, medical schools, and

[3] In fact, the transition may be more important than if an innovation had always been supported by hard money because a conscious decision had to be made to switch the innovation from soft to hard money. The decision itself might have been an occasion for arousing greater support for the innovation than would have occurred if there had been no decision (as in the case where the innovation had always been supported by hard money).

[4] Many local service agencies have their own personnel systems that are not necessarily part of the local civil service. For discussion purposes, the comments here are intended to apply to the official personnel system of the local agency, whether it happens to be civil service or not.

educational schools—or into the certification requirements for practice, or both (Yin, 1976). When the skills needed to operate an innovation become part of a profession's standards, the professional school curriculum, or the certification requirements, the innovation has thus made a significant passage toward routinization. An example here would be the use of CAI in the classroom. Most state educational agencies do not yet require that mathematics teachers have any formal training in computer science to be certified. Consequently, there are teachers who not only lack that training, but who may also have a negative attitude toward the use of CAI. If such training were required and if all incoming mathematics teachers could only gain certification by having this training, the likelihood of CAI becoming a regular part of the mathematics classroom practice would be increased.

For many local service agencies, there is also continual, in-service training. Fire and police officers typically participate in daily or weekly drills. The officers also return two or three times a year to special training facilities, where they learn about new practices and refresh their knowledge about old ones, and tests are often administered to assure that they have maintained a basic performance standard. Teachers may similarly have formal in-service training requirements that are linked either to on-the-job performance or to promotions, and personnel in most services are generally subject to periodic training sessions. Under such conditions, the more routinized innovation is one with skill requirements that have been conducted in more training cycles.[5] In this manner, the skills will not only have been taught to more personnel, but they will also have been taught over a period of time to more generations of personnel.

Organizational Governance. The formal rules by which a local service agency operates are usually specified quite explicitly.[6] The rules may occur in many different contexts; for example, in:

- Statutes that authorize an agency or appropriate funds to it.
- State or local laws (ordinances) that deal with agency revenues or work practices.
- Regulations that describe an agency's authority, organizational structure, or procedures.
- Agency collective bargaining agreements or other contractual obligations.
- Agency operating manuals or other written procedures for day-to-day operations and the maintenance of service standards.[7]

Often the formal rules are manifested in the administrative forms used within an agency, the specific data collected by the agency, or the flow of paperwork from desk to desk.

[5] This is a somewhat simplified description of the situation. The skills may initially be taught during these periodic training sessions but then may be incorporated by the professional school curriculum. As new practitioners are exposed to the new curriculum, the need for the original training sessions may be reduced, and these sessions may then cease. Cessation under these conditions would not be interpreted as a sign of a less routinized innovation.

[6] These rules, embodied in statutes, regulations, and procedural manuals, were a major focus in Blau's classic study (1955) of bureaucratic change. Blau found that new regulations frequently replaced old ones (p. 238), and he used these observations as evidence that the agency under study was continually changing rather than remaining stagnant.

[7] A comparison among local services can lead to the interesting analogy between textbooks in education, which are the guidelines for the daily operations and standards, and the use of operating manuals in the other services. The textbooks, for instance, perform many of the same functions as "orders of the day" serve in police and fire departments. In this manner, textbooks do not merely convey the curriculum; they are also bureaucratic devices that define the relevant service practice.

For most of these governance rules, the notion of a passage is slightly more important than that of a cycle because the rule-generating process may not occur on a cyclic basis. Thus, wherever some aspect of the innovation becomes part of the organization's formal governance, such a passage may be regarded as a significant step toward routinization. For instance, an innovation may become part of a formal reorganization (a change in organizational status), which would integrate the innovation into the organization. Some innovations may not necessarily become a formal part of an organization's governance, but may be closely associated with some condition of governance. A state law, for instance, may mandate a certain distribution of the agency's work force over different hourly shifts. To create such a distribution, an agency may use an innovation—e.g., a computer-based analytic program—which has thus not been mandated by the law but which has been very closely associated with its implementation.

Finally, organizational governance can also be affected by normative practices. That is, even in the absence of formal mandates, a practice that becomes widespread will become an integral part of an agency's responsibilities. Thus, an innovation that has attained widespread use will have made a major step toward routinization. Conversely, an innovation that is continually operated on only a limited basis will tend to be seen as a special project or operation, no matter what the formal mandate. Because widespread use may be gradually achieved on a phased basis, the notion of cycles appears more appropriate than that of passages.

Supply and Maintenance Operations. These are also key resources in providing sustenance to any innovation. A key piece of equipment that is part of the innovation (or the entire hardware component of the innovation) may need to be replaced or upgraded. The innovation may also require a specific set of supply or special maintenance procedures. Again, with each type of operation, there tend to be passages and cycles.

A passage occurs when an agency establishes the necessary supplies as part of its regular inventory, and not items for special order. Thus, for many innovations, the initial supply and maintenance services may have been provided by the vendor (external to the agency). These services may have been part of a leasing arrangement, may have been contracted separately, or may have been provided by some other agreement. When such innovations are first serviced by an agency itself (or contracted on a long-term basis), however, this may be regarded as a significant step toward routinization. This internal capability means that the necessary supplies are maintained as part of an agency's regular inventory and that the agency's own maintenance shop can make any repairs and perform the periodic servicing of the innovation.

Cycles occur when equipment is upgraded or replaced. The calendar time of these cycles varies and is related to the type of equipment involved. For instance, fire departments generally purchase new fire trucks at a very low rate because the lifetime of a fire truck is often more than 20 years. In contrast, the mobile fleet of a police department will turn over about once every five years. Regardless of the calendar time, one procedure that may be important for successful survival is the development of new purchasing specifications for equipment related to the innovation, to be used for all subsequent purchases.

The Complete Passages and Cycles Framework. The state of routinization of an innovation may be defined in terms of a number of organizational conditions,

each of which reflects some essential aspect of organizational operations in maintaining an innovation over time. For every condition, routinization has been defined as a combination of passages and survival over a number of cycles. In general, *an innovation shall be considered more routinized the more passages or cycles it has achieved.* Table 5 summarizes these conditions; all but two[a] became the subject of actual study in the following chapters.

The framework of passages and cycles appears to have certain appealing characteristics in providing operational insights into the routinization process. For a particular agency or locale, certain passages or cycles may be difficult to accomplish. It may be well known that changes have rarely occurred, for instance, in the supply and maintenance operation of an agency, and that any investment of energies to routinize any innovation will be wasted. Before any changes can be made to routinize an innovation, the whole subsystem may have to be revamped (typically, the head of the supply and maintenance operation may have to be replaced). Under such conditions, advocates for routinizing a specific innovation would be better off if they concentrated their efforts on other passages or cycles. In the long run, of course, the existence of numerous institutionally blocked passages could then become an operational definition of a stagnant (non-innovative) agency.

Three other issues should be raised that are especially relevant for designing an empirical study. First, because it is difficult to keep track of all the various cycles, an initial empirical achievement would simply be to note whether the first cycle had occurred or not, for any given category. This will be the strategy pursued in the following study. Second, in conducting any analysis of routinization, the various passages and cycles represent separate dependent variables. Currently, there is no rationale for deciding which passages and cycles may be more important, or for believing that the passages and cycles are similar units of measure that can be aggregated even if weighted. Thus, the creation of any aggregate index of routinization should only be undertaken with great caution but may still be a necessary shorthand for analyzing empirical data. Third, although the definition of routinization has attempted to be comprehensive in order to be conceptually complete, there is no reason that a single empirical study should be expected to cover the entire scope of what has been conceptualized. Indeed, our intention has been to define routinization in such rich terms—because it is a complex process—which can only be adequately investigated by a large number of empirical studies.

Factors Affecting Routinization

Because the passages and cycles framework just described represents a considerable elaboration of previous thinking on organizational change, the framework will be the main focus of the empirical analysis to follow in Chapters IV, V, and VI. However, some rudimentary thoughts may be presented regarding the factors leading to routinization. Although empirical evidence will be examined in Chapter VII, this is a topic in which substantial further research will be needed.

During the period that an innovation is being introduced, there can exist any number of factors that may affect the routinization outcome—i.e., the specific

[a] The two passages or cycles were omitted because: the budget cycles occur annually and hence were synonymous with the chronological age of the innovation, which is treated as a separate independent variable; and the training cycles vary considerably and are poorly documented in most agencies.

Table 5

Organizational Passages and Cycles Related to Routinization

Type of Resource or Operation	Passages	Cycles
1. Budget	Innovation supports changes from soft to hard money (2)[a]	Survives annual budget cycles
2. Personnel		
Jobs	Functions become part of job descriptions or prerequisites (5)	---
Incumbent turnover	---	Survives introduction of new personnel (9) Survives promotion of key personnel (8)
3. Training		
Pre-practice	Skills become part of professional standards, professional school curriculum (7)	---
In-service	---	Skills taught during many training cycles
4. Organizational Governance	Establishment of appropriate organizational status (3) Use of innovation becomes part of statute, regulation, manual, etc. (6)	Attainment of widespread use (10)
5. Supply and Maintenance	Supply and maintenance provided by agency or on long-term (contract) basis (4)	Survives equipment turnover (1)

[a]Numbers refer to ten passages and cycles studied in actual life histories (see Chapter VII, Table 11).

passages or cycles that will be achieved. Each of these factors is a complex set of circumstances, which can also change over time, so that the process suggested here goes far beyond the Innovative Organizations approach, in which static factors are correlated with innovative outcomes. For instance, a key factor in achieving routinization may be the continued support of an external constituency (e.g., clients of the service, potential clients, or the community at large). Such support can rise and decline over time, and there is no single point for measuring support that would necessarily represent the characteristics of support during other points in time. Although this causes immense problems of measurement for any empirical study, the spirit of the following discussion is an attempt to describe the importance of a group of factors independent of any concern for establishing definitive measures for empirical study.

The factors that may be hypothesized to affect the routinization of an innovation can be classified into five subgroups, those that are related to:

- Inherent characteristics of the innovation.
- Service applications and outcomes of the innovation as experienced by an agency.
- The external environment of the local agency.
- The internal characteristics of the agency.
- Federal or state support for the innovation.

Of these five subgroups, the last four are discussed in the following subsections. The first, which deals with the inherent characteristics of the innovation, was covered in Chapter II.

Service Applications and Outcomes. Three factors are hypothesized to be relevant here: The innovation has involved a core application; competition among applications has been minimized; and the innovation has shown some service-related payoff. An innovation may be used in a number of ways by a local agency, and this application may vary from site to site. Previous research has suggested that innovations are more likely to be routinized if the innovation is applied to a *core application* rather than to a peripheral function of the agency (e.g., Berman et al., 1975). The core is not easy to define. For instance, each agency can have core administrative functions (e.g., administering the payroll) as well as core service functions (e.g., providing medical treatment to a patient). For administrative functions, it might be possible to enumerate core activities such as budget, personnel, and maintenance; for service functions, it might also be possible to enumerate as core functions those that directly reflect service goals or standards. However, there appears to be no completely satisfactory approach for defining what a "core" function is, even though there may be some degree of consensus among service administrators when they set their priorities.

One suggestion from previous research has been to determine whether an innovation has displaced some significant function (Berman et al., 1975). If displacement has occurred (as opposed to a new function that has been merely added on), the argument is that a core function is more likely to have been involved. Such a view, however, precludes the notion that core functions might be increased (as in the case of a paramedic rescue squad that provides on-site medical treatment that was never provided in the past), so displacement can only be part of the story. Nevertheless, for most innovations, displacement can be one criterion for determin-

ing whether a core function has been involved. Where no displacement has occurred, there must be some compelling evidence before one can conclude that a new core function has evolved.

Competition among applications occurs when an innovation can be used for a variety of functions. Some innovations are, by their nature, limited to a single function (see Chapter II). However, the important factor here is whether, given an innovation that can be used for a variety of functions, the local agency has applied it in such a way that there is strong competition among applications. An example would be the competition among administrative and service functions for using a central computer. Such competition may retard routinization because:

- Resources and support for the innovation may be divided among different constituencies within and outside the agency.
- Passages and cycles in relation to one application may not be compatible (or at the very least, will have to be coordinated) among applications.
- There is less likely to be a single supporter of the innovation who can marshal the necessary support for it—i.e., each potential supporter of the innovation may believe that others will play the more prominent role.
- The alternative applications will create instability in the everyday operation of the innovation, as crises or other events may give reason for shifting emphasis from one application to another (and back).

Naturally, this situation pertains only when the several applications are in competition with each other. In contrast, there may be any number of situations in which different applications are highly compatible and can all be accommodated easily by an innovation. In such situations, there will be more support for the innovation and the diversity of applications will serve as a positive influence on routinization.

Service payoffs from an innovation can be reflected in output measures, input measures, perceived satisfaction or convenience by key personnel, or other objective or subjective assessments. The more clearly an innovation has demonstrated such a payoff (even if in subjective terms), the more likely the innovation will become routinized (Berman et al., 1975). There may have been no formal evaluation of the payoff, or the payoff may not have produced an outcome that was considered central to the agency's purpose (e.g., educational achievement, public safety, or good health). The main characteristics of such a payoff are that it is of a specific nature, that it is perceivable by many people, and that there is some consensus that the payoff exists. The earlier and more sustained evidence of such a payoff, the better. The payoff is important for routinization because it allows advocates to argue more forcefully during key passages and cycles.

External Environment. An innovation may be initiated in relation to a prior need or crisis outside the agency (or no problem or crisis—as in the distribution of a new technology, independent of need); it may be strongly or weakly supported by the users or clients of the agency's services or by the community at large. All these conditions are hypothesized to influence the degree to which an innovation becomes routinized.

The nature of the *prior need* can affect routinization in both directions. If a crisis were perceived as a single isolated occurrence (e.g., the need to innoculate people against the swine flu), and if an innovation were tailored specifically to serve that crisis, routinization would be less likely to occur because, when the crisis was

over, the perceived need for the innovation would disappear.[9] In contrast, if the prior need were perceived as a prolonged or chronic affair (e.g., declining educational achievement scores or continued racial segregation), the innovation is more likely to be routinized. (This might occur even if the crisis eventually were to subside, for it would be difficult for the agency to return to its prior practice.) Naturally, as with the problem of defining a core function, it is not always clear what constitutes a crisis or prior need. The sense in which the term is used here, however, is that a prior need may be said to exist if it is only a perceived need (rather than some objectively assessable condition).

Client support for an innovation can be a complex factor, because most service agencies have a variety of clients (e.g., students of different interests within a school as well as their parents), and not all clients may benefit equally from an innovation. Nevertheless, on balance, if there is active client support for an innovation, it is more likely to become routinized than if there is no such support or if there are conflicts among client groups. Such support could be made known informally, as when clients report their satisfaction with a situation to service practitioners, or it could be made known quite formally, as when students select courses in their pre-registration forms. This client support can obviously change over time, and it is difficult to determine which time period, if any, is more critical than other time periods. Suffice it to say that routinization will occur with greater certainty if client support is strong and sustained, or, if it is strong but intermittent, the peak support periods occur at the times that will most influence decisions concerning the key passages or cycles.

Community support for an innovation operates in much the same fashion, except that the support comes from the polity at large rather than from only those who are eligible to use the service. Strong and sustained support will have a positive effect on routinization (Costello, 1971), whereas little support or the existence of community conflicts may have detrimental effects. As with client support, community support can also be transmitted through formal and informal channels. The former ones include local referenda or votes on service-specific revenues;[10] the latter are expressed through the relationships between citizens and service officials, often mediated by local politicians.

Internal Characteristics. Internal characteristics cover conditions within the local service agency. In general, an innovation is hypothesized to be more likely to become routinized if it has greater support from the staff within an agency (Yin, Heald, and Vogel, 1977). Such support can come from a single innovator, who actively seeks to institutionalize the innovation by working on passages and cycles; agency administrators, who often make the key decisions concerning those passages and cycles; and service practitioners, who must incorporate the innovation into their own perception of "normal" practice. Such support can be challenged if the innovation has any adversary group, as would be the case if certain staff members had originally been opposed to the innovation or had lost status or power during implementation conflicts. The importance of internal support cannot be

[9] Note, however, that a single occurrence may be more than sufficient to result in adoption and implementation.

[10] In one city in the case studies, the authors actually found an innovation-specific tax levy, with the local community voting every five years on whether to support the costs of the police computer system and its connection to the regional FBI computer network.

overstated. In many cases, an innovation can serve bureaucratic self-interests—e.g., growth rate of promotions, increased agency status—and thus become routinized even though there have been no distinct service payoffs (Yin, 1977).

The importance of a *single, active innovator* who protects the innovation and guides its progress through passages and cycles has been frequently noted in previous research on adoption (e.g., Rothman, 1974). This innovator will most often be the one who best understands the innovation and who can—when necessary—provide the direct maintenance and repair services required by the innovation. Other agency staff who have questions about the innovation or who want to recommend revisions in its operation will refer first to this innovator. Finally, this person is also the one who initially helps to organize staff training programs and other orientation activities.

The same innovator may also be concerned about routinization and can take many actions to increase an innovation's success in passages and cycles. This may include generating client support for the innovation by creating a diverse set of functions for the innovation, initiating practitioner certification requirements, or pressing for conversion from soft to hard money whenever additional funds are available. Failure to take such actions will not always irreparably harm the routinization process. However, the absence of such a single, active innovator for some initial period of time will probably mean that an innovation will fail in a particular agency. (Of course, over time, the innovation's ability to survive the turnover in this key position will be a positive sign that routinization is occurring.)

The support of an innovation by agency administrators is important because these administrators: (1) define the initial circumstances under which an innovation will be used, e.g., its organizational location and resources available (Tansik and Radnor, 1971), and (2) are later involved in key decisions regarding passages and cycles. The existence of some *support by agency administrators*, whether it comes from the chief executive (Costello, 1971; and Perry and Kraemer, 1976), from the agency budget officer or comptroller (Bingham, 1976), or from a key line official, appears important to initial adoption. Recent evidence has also suggested, however, that top administrative support becomes even more important as an innovation becomes routinized (Lambright and Flynn, 1977). Thus, the innovation has the best change of success if it maintains a coalition of supporters from the top administrators (House, 1976; and Lambright and Flynn, 1977).

An innovation will also not become routinized without *widespread support among service practitioners.* The extent of potential support is defined by the practitioners whose work can in theory be affected by the innovation. With some innovations, this involves all the practitioners within the agency; with others, however, only some practitioners are potentially affected (e.g., nurses in a hospital but not doctors, detectives but not patrol officers, language teachers but not all teachers). The greater the actual support from whatever group is actually affected, the more likely an innovation will become routinized.

Lastly, every innovation can have an internal, *active adversary group.* Such a group may have formed during any stage of the innovative process from adoption to implementation. In particular, if the adoption and implementation stages involve internal conflict and produce strongly negative views toward the innovation, the persons with such views will continue to act to retard the routinization process

(Tansik and Radnor, 1971).[11] In contrast, an innovation that had originally been adopted or implemented with relative ease (i.e., one in which there was a high degree of internal consensus all along) is not as likely to have an adversary group.

Federal or State Support. An important policy issue of recent decades has been the extent to which external support from federal or state governments can facilitate innovation in urban bureaucracies (Roessner, 1976). For this reason, it is necessary to examine the relationship between such support and routinization outcomes. However, the support may be considered an exogenous factor, not having the same role in organizational theory as the previously identified factors. Such support can take the form of direct funding for the innovation, funding of special projects prior to or following adoption that are related to the innovation, or technical assistance.[12]

Summary

Routinization consists of the achievement of certain *passages* and *cycles*, which are organizational events in the life history of an innovation. A passage occurs when an innovation makes a transition from one organizational state to another—e.g., the shift from soft to hard money. A cycle occurs when an innovation has survived a periodic organizational event such as turnover in personnel.

The important passages and cycles are based on the resources required by most innovations: budget, personnel, training for service practitioners, sanction through rules of organizational governance, and supply and maintenance operations. Ten specific passages and cycles have been identified for these resource areas, and the more passages and cycles an innovation has achieved, the more routinized it may be considered. Thus, if all passages and cycles have been achieved, an innovation should have become a part of an agency's regular operation, and the innovative practice indistinguishable from standard agency practice.

The framework of passages and cycles is an extensive elaboration of the Organizational Change approach to studying innovations. This as well as three other prominent approaches to innovation were reviewed briefly at the outset of the chapter. None of the approaches, however, has developed systematic operational criteria for assessing changes over time within an organization. In this respect, the passages and cycles framework represents a potentially significant advance for studying bureaucratic innovation. For this reason, the next three chapters attempt to describe in detail the empirical evidence from 19 case studies in light of this framework.

Ten factors that may play a causal role in negotiating passages and cycles were also hypothesized in a preliminary manner. These will be examined briefly in Chapter VII, in light of the evidence from the case studies and data from the telephone interviews.

[11] See Watson (1969) for a description of the development of adversary groups and of the adversary process.

[12] Studies of intergovernmental relations are just beginning to cope with the varied efforts—direct and indirect—of federal and state policies on local government behavior (e.g., see Pressman and Wildavsky, 1973). Until further developed, however, it is impossible to specify the differential impacts of such initiatives as regulatory policies, transfer payment programs, direct aid, indirect aid programs, and technical assistance. Thus, only the most prevelant forms of innovation-related policies—i.e., direct funding and technical assistance—were examined in our own analysis.

Chapter IV

LIFE HISTORIES, STAGE 1: THE IMPROVISATION STAGE

A. OVERVIEW OF THREE STAGES

The framework of passages and cycles guided the collection of evidence from 19 case studies and 90 telephone interviews. In each of these efforts, the life history of an innovation at a specific site was recorded (Chapter I listed these sites). On the whole, the life histories sought to ascertain if and when the various passages and cycles had occurred. In addition, rudimentary questions were asked about the factors hypothesized to facilitate or hinder routinization.

The 19 case studies provided the fuller set of data regarding the course of routinization over time. For this reason, this body of evidence was used in Chapters IV, V, and VI to establish the basic outline of the routinization process. The use of the case studies, as pointed out in Chapter I, had followed an explicit **chain of evidence.** First, the data collected in the field had been dictated by an interviewer's guide that covered four general topics (background, description of the innovation, status of routinization, and reasons for routinization status) and that contained specific questions concerning passages and cycles. Second, each case study thus consisted of parallel types of information about each innovation at each site, and this allowed the uniform reporting of each case study, as illustrated by the narrative case studies in Appendix C. Third, the narratives were then analyzed according to the key events that had occurred, and these events were listed in rough chronological order.[1]

From this chronological listing emerged the first finding from the case studies: *each life history could be divided into three general stages*—an Improvisation Stage, an Expansion Stage, and a Disappearance Stage. The distinctions among these three periods were not sharp ones. What was important was that the stages were conceptually useful and that there were clusters of activities associated with each stage, although the specific events that marked each period could vary from case to case. Thus, even though innovations may have matured at different rates and in a somewhat uneven manner, the three periods still gave some sense of stages of growth, with the stages following in a temporal sequence.

The Improvisation Stage was the initial period during which an innovation began to operate (following adoption), and no passages or cycles had to occur during this period (although they often did in the various life histories). Instead, the main theme was merely to keep the innovation operating at some meaningful level and for some meaningful period of time. Usually, this meant that the innovation was used to perform at least one or two functions through a calendar year. The Expansion Stage was marked by both the continued growth of the innovation and the achievement of several passages or cycles. Finally, the Disappearance Stage involved the completion of the remaining passages and cycles, and the period was one in which the innovation continued to be used but eventually lost its recognition as

[1] The telephone interviews did not always contain specific dates and were thus less susceptible to this approach. The telephone interview data will be integrated into the discussion in Chapter VII.

an innovation. During this last period, in other words, an innovation achieved the status of standard agency practice.

The delineation of the three stages guided the grouping of chronological events in the life histories into three periods of time. The resulting table of events for each of the 19 case studies is contained in Table 6. This table was drawn directly from the case study narratives—and represents the next step in the chain of evidence from the case studies; the table thus serves as the basic source of evidence for the findings in this and the next two chapters. To understand the table, the reader should note that: (a) the periods follow in chronological order but (b) each period may represent a different duration of calendar time. What distinguished the periods from each other was the occurrence of specific passages or cycles. Certain of these events tended to occur early in the life history, while other passages or cycles tended to occur late. This information became the basis for distinguishing among the three stages.

The remainder of this chapter and the following two chapters present the findings regarding these three stages in an innovation's life history. The chapters are based on specific citations from the case studies, as reflected by the key events listed in Table 6. Specific passages and cycles are discussed in Chapters V and VI, and each discussion ends with a summary tabulation of the passages and cycles achieved by each case study. Because the events in the table constitute the raw data used in these tabulations, the key passages and cycles for each life history are indicated by a number in parentheses (the number refers to the passage or cycle number of the text). This notation will enable the reader to follow directly the chain of evidence from table of events to findings.

Chapter VII then aggregates the passages and cycles achieved by each of the case studies and, depending upon the number achieved, categorizes the 19 case studies according to their degree of routinization. A similar procedure was followed for establishing the routinization status for the innovations from the 90 telephone interviews. Most of Chapter VII is then dedicated to a summary discussion of the routinization process, taking into account an examination of the factors previously hypothesized to explain the routinization status of each innovation. The conclusions and their implications for future policy research are reported in Chapter VIII.

B. THE IMPROVISATION STAGE

The main characteristic of this initial period in an innovation's life was that major operations were undertaken for the first time. It was the first time that equipment was used and repaired, that practitioners and other employees received training in using the innovation, and that new organizational procedures for the innovation were developed. Because every local agency had its own unique tradition, staff, and situation within the municipal government, it was difficult to plan these activities precisely. Different factors were of slightly different importance from agency to agency. Supporters of the innovation therefore needed to remain flexible, resourceful, and patient as they established the initial routines. Above all, they had to be prepared to improvise. For instance, they had to know how to balance their reliance on outside consultants and vendors for technical assistance with their own ability to make on-the-spot repairs. Because there were few precedents, the initial period in the life of an innovation could thus be characterized as an *Improvisation Stage*.

Four features in particular marked this initial period: practitioner exposure, resource management, the nature of the key innovators, and the strategic choices made by the innovators. However, the Improvisation Stage did not have to involve any specific passages or cycles (even though some passages or cycles may have actually occurred in some case studies). The main goal of the Improvisation Stage, in other words, was the organizing of certain activities without regard to the formal organizational changes implied by specific passages and cycles. The activities were often organized in an ad hoc and transient manner. The following discussion therefore covers these improvisation activities.

Practitioner Exposure

Most innovations required knowledgeable initiatives on the part of service practitioners. In schools, the use of CAI and CCTV depended directly on the initiatives taken by teachers in individual classrooms, and not just the actions carried out by administrators and coordinators. Adoption and implementation therefore took place at two levels, an administrative level that coordinated the entire system, and the classroom level, where some teachers might have simply chosen to avoid the innovation even though it had been adopted at the administrative level. With the Jet-Axe, breath testing, and MICU, practitioners had to learn how to use new techniques that in some cases totally displaced traditional procedures. Only in the case of police computers was it possible to initiate the innovation on the basis of functions that did not directly involve the street-level police officer (e.g., the statistical aggregation of Uniform Crime Reports to be sent to state or federal agencies).

Because of the key role played by practitioners, the improvisation period had to include some opportunity for improvisation by practitioners. This frequently took the form of pilot projects and training that preceded the actual adoption of the innovation. In all the CAI cases, for instance, small groups of teachers had opportunities to experiment with CAI techniques. In Dallas, the opportunity was provided by a grant from the National Science Foundation that supported several CAI terminals and computer time leased from a computer firm. In San Diego, a similar opportunity was provided by summer projects funded by private sources. In Tampa and Oakland, practitioners themselves initiated requests to school administrators to purchase programmable calculators so that these could be tested in the classroom. These opportunities generally resulted in a small group of practitioners (usually mathematics teachers) gaining knowledge of CAI capabilities. The specific CAI applications, of course, were highly diverse and unstructured, but the experience was then used as feedback to central administrators who were contemplating the adoption of the larger and formal CAI system. In most cases, the teachers were able to provide specific information on the desirable characteristics of the core computer that would best accommodate CAI applications. In one case, San Diego, these early teacher experiences actually led to the main initiatives and support for purchasing a CAI system entirely separate from the computer system that served administrative functions.

With other innovations, early practitioner exposure played an equally important role. In the Birmingham experience, the MICU system was being installed for the first time and had been adopted on the basis of strong top administrative support. However, the initial coordinator carefully (and personally) selected the first class of fire officers who would receive paramedic training and operate the

Table 6

Table of Events for 19 Case Studies

A. Police Computers

Site	Improvisation Stage	Expansion Stage	Disappearance Stage	Current Status
Miami	New police chief hired $20 million bond issue approved; includes funds for second generation computer (6) First generation computer (NCR Century 100) leased on local funds; batch processing only (2) External funds for special analyses Data processing established as separate organizational unit (3) UCR data submitted to state on tapes (1969-1973)	New chief hired (had helped plan data processing system) (8,9) Second generation computers (PDPs) being installed (1) Data processing staff increases; new civil service classifications established (5) New computer capacity relieves competition among applications Expansion to dispatch and case entry applications will use mobile, on-line terminals New forms developed Continued support from assistant to city manager New chief reviews printouts himself (1974-	Data processing survives across-the-board budget cuts	Police department: about 1,200 persons City population: about 340,000 On-line terminals being installed No training yet for street officers
Indianapolis	First generation computer (IBM 1440) leased on local funds (2) Data processing established as separate organizational unit; county civil service positions used (3) Some technical assistance by a consultant group Deliberate replacement of old forms as new applications are automated (1964-1968)	Second generation computer (IBM 360) leased (1) Programmers recruited from sworn staff (5) First generation of terminals requires training procedures for clerks and officers Case entry application initiated County-city government merger Third generation computer (IBM 370) leased; continued close service support from vendor (4) Data processing system and county data processing system share administrative applications and serve as backups to each other; data processing applications expanded (6) (1969-1974)	Data processing orientation offered in police academy (7) Second generation terminals leased New chief hired (had been head of data processing system); new department head (8,9) Data processing survives budget cut in department Dispatch application being added with new minicomputer (1975-	Police department: about 1,400 persons City population: about 740,000 About 70 on-line terminals, including some second generation terminals (10) External groups and agencies use terminals and data (10) No comprehensive manual

Nashville	First generation computer leased on local funds and does batch processing only Deputy chief designs second generation system and applies for LEAA funds (1965-1970)	Second generation computer (Univac 418) consists of two cores, one for on-line and the other for batch; each is backup for other; leased on LEAA funds (1) Data processing established as separate division (3) New chief is hired and supports data processing system (former chief had opposed it) Vendor-provided service support is ended (4) On-the-job training for clerks and officers Old forms are revised; data processing applications are expanded County computer performs administrative applications (1971-1975)	Data processing supported on local funds; long-term lease is up for renewal (2) Civil service classifications for data processing staff being updated (5) New data processing head is hired (had been employed by vendor) (9) Data processing orientation offered in police academy (7) Training manual for using terminals is implemented (1976-	Police department: about 1,400 persons City population: about 450,000 About 95 on-line terminals (10) Computer system is used by other criminal justice agencies in metropolitan area (10) Competition from county computer
Boston	First generation computer (IBM 360/30) leased on local funds (2) Data processing established as separate organizational unit (3) Civil service classifications all covered under state civil service system (5) New data processing head is hired Vendor provides maintenance service throughout (4) (1968-1972)	Second generation computer (IBM 360/135) leased on local funds; allows new applications and interface with state computer (1) Consultant firm helps on software On-the-job training for clerks Second new data processing head is hired (9) Old forms are revised Third generation computer (Systems III) replaces 360/135 and performs message switching to access city computer but implies no new applications Initiation of computer dispatch system (two minicomputers) purchased with LEAA funds; consultant firm helps on software and planning (1973-1976)	Data processing survives across-the-board budget cuts Computer dispatch system remains separate from city computer and is being implemented New chief is hired and reviews printouts himself (had helped implement IBM 360/135) (8) (1977-	Police department: about 3,000 persons City population: about 640,000 About 50 on-line terminals, but street officers have little direct contact yet All applications except dispatch are now processed by city computer Union continues to oppose data processing system No training yet for street officers

B. Breath Testing

Site	Improvisation Stage	Expansion Stage	Disappearance Stage	Current Status
Cincinnati	Traffic section participates in FARE program Cincinnati becomes site for $2.1 million ASAP grant; 3 Breathalyzers purchased and 12 traffic officers trained; videotapes also used; traffic commander coordinates equipment located in one subdistrict Some technical assistance from federal officials State board of health offers training and certification free of charge Revision in procedures manual and forms Use of videotapes discontinued State law does not mandate breath testing, but if such testing, Breathalyzers were only certified equipment at the time (1970-1974)	State board of health provides refresher training and recertification Officers in traffic section continue to provide all maintenance (4) Police department further decentralizes; breath testing procedures incorporated into all subdistricts (3) (1975)	Police department initiates training in police academy, including senior operators and refresher course (5,7) Five more Breathalyzers purchased with 50-percent state funds, one placed in each subdistrict; three old ones used for training or backup; all maintenance and supplies on local funds (1,2) Breath testing survives across-the-board budget cuts New police chief hired Traffic commander (coordinator) needs to spend less time on innovation (1976-	Police department: about 1,000 persons City population: about 450,000 About 140 officers (most outside of traffic) can operate and repair equipment (10) About 3,500 DWI arrests per year and rising; other payoffs identified in formal evaluation Maintenance and repair officers are still same incumbents No changes in civil service classifications or promotion incentives contemplated; but has internalized training and certification
Akron	Traffic commander and judge had sought improvement over urinalysis Chief decides to purchase two Breathalyzers; one is backup; nine officers trained; videotapes also used; lieutenant serves as coordinator (2) State board of health offers training and certification free of charge State law does not mandate breath testing, but chief mandates that only Breathalyzer be used Videotape procedures entered into department's standard operating procedures (1968-1972)	Coordinator initiates own training program for regular operators; state continues to provide training for senior operators and refresher course (and charges police department) Procedures for breath testing entered into department's standard operating procedures (3) Maintenance provided by traffic bureau (4) Breath testing orientation in police academy Third Breathalyzer purchased with 50-percent state funds; is used as another backup (1) (1973-1976)	Breath testing survives budget cuts; however, fewer DWI arrests because of fewer patrols New coordinator (who does not train) is hired (9) (1977-	Police department: about 500 persons City population: about 270,000 About 45 officers (most in traffic) can operate and repair (10) About 450 DWI arrests per year; decline from 800 in 1971 Location of training program uncertain Other jurisdictions receive training and make some use of Breathalyzer No civil service changes or promotion incentives contemplated

Memphis	Photo-electric breath tester used (1953-1973); slow procedure and instrument does not give BAC reading; only one stationary instrument Traffic committee reviews possible mobile units Innovation begins as joint police department-sheriff venture, with personnel costs shared and DWI unit placed in own metropolitan organization; twelve men transferred and three gas chromographs purchased; delay in delivery of two mobile vans allows piecemeal orientation to new system; full procedure is to have vans arrive at a DWI stoppage on street by regular patrol officer, and to conduct breath test on the spot; state funds used for equipment (2) Training and certification required by court, program run by university, augmented by state-funded course run by DWI unit Full-time DWI coordinator appointed (1972-1973)	New police department chief is hired; more supportive than predecessor Two additional vans and gas chromographs purchased (1) New officers continue to be assigned to DWI from regular police department ranks Technical assistance from vendor only occasionally needed DWI unit issues formal procedures but not as part of department's standard operating procedures One additional van purchased and first two traded in; equipment purchases continue to use state funds or sheriff's office budget DWI unit gradually assumes all maintenance and repair responsibilities; many technical problems slowly overcome (4) (1974-1976)	Planning to trade in all five vans and replace all gas chromographs for new models Police department faces budget cuts, has difficulty paying for officer overtime in DWI unit (1977-	Police department: about 1,500 persons City population: about 630,000 Twenty-one officers, five vans, and three squad cars are all part of separate police department-sheriff unit About 8,000 DWI arrests and rising (10) Revenues from DWI fines (about $100 per case) go to city or county, but not used to explicitly offset budget expenditures for DWI unit Sheriff's office takes care of most administrative procedures No civil service changes or promotion incentives

C. Mobile Intensive Care Units (MICU)

Site	Improvisation Stage	Expansion Stage	Disappearance Stage	Current Status
Dallas	City had contracted with funeral homes for private ambulance service Ambulance committee (medical and municipal representatives) formed (1969) Proposal for county-wide system defeated (1971) Mayor and council implement MICU in fire department with ordinance and revenue-sharing funds; 16 vehicles provide EMT transport only; 150 men trained by medical school; coordinated by officer who became chief of ambulance division (2,6) Ambulance division formed in fire department (3) MICU expansion with 120 paramedics trained from EMT; revenue-sharing funds for equipment Officers certified by state, receive extra pay for being MICU-trained City and vendor offer initial technical assistance (1972-1974)	Seven new units eventually added; one unit supported by private donation More fire officers given MICU training Fire department increases maintenance staff to repair MICU vehicles and equipment; worn out parts replaced and updated New forms developed and updated Fire department no longer depends on external technical assistance (4) New chief hired and is more supportive (had been head of planning and research) (1975-1976)	MICU helps fire department avert across-the-board budget cuts Training program continues free of charge to fire department, expands to other municipalities by charging fee Revision in promotional structure for officers considered (1977-	Fire department: about 1,400 persons City population: about 850,000 About 17 active and 6 reserve MICU units cover entire city $40 charge for each MICU transport Other communities use system Original chief of ambulance division is still same incumbent; not all procedures formally documented
Birmingham	Advisory MICU committee formed (1968) by city ordinance Large federal MICU grant not funded (1969) MICU initiated with DHEW funds; one vehicle; local funds support after first year, as well as purchase of two more vehicles (1,2,3) Head of MICU committee (outside fire department) initiates training and coordinates with state Fire department chief and deputy chief are strong supporters, select exemplary trainees (1973-1974)	Training continues at university (76 certified paramedics, more being trained, although all units fully staffed) Three more vehicles purchased Civil service classifications established for paramedics (5) Fire department changes name to include "Rescue Service" (6) Paramedic assignment part of fire department promotion ladder, involves small additional pay (8) State MICU regulations incorporate fire department's experience (1975)	Second generation of Lifepaks being installed Civil service classification being sought for MICU coordinator Full-time MICU coordinator established and new incumbent appointed; creates standard procedures bulletins (4,9) Fire officers begin large-scale citizen training program in cardio-pulmonary resuscitation MICU helps fire department avert across-the-board budget cuts (1976)	Fire department: about 600 persons City population: about 300,000 About six active and one reserve MICU units cover entire city No transport service, which is still private MICU responds to about half of all fire department calls Head of MICU committee is still same incumbent

Denver	General Hospital begins own MICU system (1973) Fire department is asked by General Hospital to initiate MICU to one outlying community; all training (14 officers) and equipment covered by federal funds and administered by General Hospital; paramedics receive extra pay, covered by fire department funds Only low number of calls for this unit General Hospital withdraws training, certification, and support after one year; fire department service ends General Hospital, and not state, plays certification role (1975-1976)	Fire department continues to consider MICU training for own personnel (1977-		Fire department: about 950 persons City population: about 520,000 No MICU units currently in operation under fire department General Hospital operates MICU with about 11 units

D. Jet-Axe

Site	Improvisation Stage	Expansion Stage	Disappearance Stage	Current Status
Rochester	Commissioner (of fire bureau) has academy test Jet-Axe and decides to purchase ten Jet-Axes with local funds; six more Jet-Axes purchased shortly thereafter; fire officers trained in fire stations (1,2) New procedures incorporated into training manual (3) Trucks carry Jet-Axes but then transferred to chiefs' cars (1972-1973)	Fire bureau becomes department; new chief, who had direct experience with Jet-Axe, replaces commissioner Jet-Axes transferred from chiefs' cars to special equipment truck that responds to all fires (10) Six more Jet-Axes purchased (4) Training begins in academy (1976; had been no new trainees for 2 1/2 years); new head of academy appointed (1974-1976)	Training continues in fire stations and academy (7) (1977-	Fire department: about 675 persons City population: about 300,000 Sixteen Jet-Axes used in total (six for training, ten for fires) No maintenance, reorganization, or new forms needed Use of Jet-Axes declining
Omaha	Chief decides to purchase four Jet-Axes with local funds; fire officers trained in fire stations twice a year; film used to facilitate training (1) Training begins in academy Chiefs' cars carry Jet-Axes; assistant chief administers on daily basis Two more Jet-Axes purchased, limited to largest model (2) (1972-1974)	Use of Jet-Axes incorporated into fire department's standard operating procedures (3) Two more Jet-Axes purchased (1975) (4) Four more Jet-Axes purchased (1976) (1975-1976)	Training continues in fire stations and academy (7) (1977-	Fire department: about 525 persons City population: about 400,000 Six Jet-Axes used in total (two for training, four for fires) No maintenance, reorganization, or new forms needed No turnover of chief or assistant chief

E. Computer-assisted Instruction (CAI)

Site	Improvisation Stage	Expansion Stage	Disappearance Stage	Current Status
Dallas	NSF grant for CAI; ten terminals and computer time purchased from private company; data processing director coordinates (3) First court-ordered school desegregation helps CAI First generation CAI computer (Burroughs 5500) acquired on lease-purchase with local funds (was second generation for administrative application); 18 CAI terminals purchased with external funds in relation to desegregation (2,4) First CAI coordinator appointed First round of in-service training for CAI (1968-1973)	New comptroller hired (had been data processing director) (8) Second generation CAI computer (Burroughs 6700) acquired on lease-purchase with local funds; more terminals (1) Two other CAI computers (Hewlett-Packard and PDP) purchased with external funds; additional applications and terminals New CAI coordinator hired (9) First mathematics CAI supervisor appointed (5) State certifies advanced computer mathematics courses (6) Second court-ordered school desegregation: impact on CAI operation? (1974-1976)	CAI coordinator's position shifted to curriculum department (1977-	District: about 140,000 students City population: about 844,000 About 110 on-line CAI terminals; time oversubscribed (10) Drill-and-practice, problem-solving applications Considering CAI-oriented mathematics textbooks Competition with administrative application for computer time Adoption and use still at teacher's discretion In-service training not yet formalized
Oakland	Six high schools purchase programmable calculators on local funds State grant to 3 elementary schools for 15 terminals; plagued by breakdowns and only operates for 6 months First generation CAI computer (Honeywell 6025) purchased with local funds (was third generation for administrative application); 13 terminals used to replace programmable calculators (2,4) Trial with computer payroll application is unsuccessful (1962-1972)	Two new data processing directors hired in quick succession In-service training offered sporadically by data processing directors Several individual CAI projects with external funds begin and end at individual teacher's initiative (1973-		District: about 65,000 students City population: about 360,000 About 13 terminals (same since 1971); time undersubscribed Main CAI application is computer programming No strong top administrative or practitioner support for CAI

Tampa	Mathematics teacher uses programmable calculator, becomes mathematics supervisor and encourages CAI First generation CAI computer (IBM 370/135) purchased on local funds (was fourth generation for administrative application); 9 terminals leased on curriculum funds; core is compatible with county computer (2,3,4) Mathematics supervisor coordinates CAI applications and offers one round of in-service training (5) Grants from LEAA and Title III support specific CAI applications (1970-1975)	One school purchases minicomputers to add single terminal; funds from school building budget (6) No turnover in either data processing director or mathematics supervisor since outset New computer being considered (1976-		District: about 120,000 students City population: about 280,000 About ten terminals (same since 1972); residual demand for computer time unclear Computer programming and computer mathematics only CAI applications Coordinator in curriculum department from beginning
San Diego	Pilot summer projects for CAI sponsored by data processing department; other test projects on private funds New superintendent hired and district is decentralized Mathematics teachers convince data processing department to extend funds (and principals to pool funds) First generation CAI computer (HP 2000) acquired on 4-year lease-purchase from school funds; data processing department provides services; initial in-service training; each of 11 participating schools has time share coordinator (2,3,4) (1969-1973)	Central computer (IBM 370) for administrative application into its third or fourth generation but is separate from CAI Second and third CAI computers (HP 2000s) acquired on same arrangement as last; 60 terminals in all; external agencies buy time and use own terminals (1) Data processing department assigns full-time CAI coordinator Special CAI account was established within data processing department, facilitates use of some federal funds In-service training formalized with credits, extra pay, maintenance/repair component (7) Bond issue approved; provides additional funds for CAI by including terminals as standard building equipment (6) Second generation of terminals purchased and applications expanded (1974-1975)	A few schools drop out, but hardware transferred to other schools CAI resource teacher hired with CETA funds; will eventually be funded from local sources CAI costs to decline because of completion of lease-purchase agreements Civil service classification for CAI coordinator updated (5) Curriculum department begins adoption of CAI-oriented textbooks Data processing department enters formal service contracts with schools Teachers with CAI training given edge in transfers to new schools (8) (1976-	District: about 120,000 students City population: about 700,000 About 60 terminals (10) External agencies use CAI computer Drill-and-practice applications

F. Closed Circuit Television (CCTV)

Site	Improvisation Stage	Expansion Stage	Disappearance Stage	Current Status
Omaha	ESEA Title III grant for media center; university professor is innovator; CCTV programs with microwave transmission and dial-access sytem for three high schools; technical difficulties in installing system; position descriptions established for staff; not much in-service training for CCTV; CCTV is special project in television department (5) Local vocational education funds used to develop television studio; CCTV staff turns over completely System modified to use ITFS, but delay in obtaining FCC approval to use ITFS channels for digital signals (needed to call specific programs to be shown) (1967-1972)	Maintenance difficulties (vendor located in distant city) Grant ends; local funds used until budget cuts eliminate system (1975); instead, district upgrades studio (2) Types of programs had increased, e.g., library of 400-500 television programs had accumulated Few teachers exposed to system; little student incentive to use it (1973-		District: about 53,000 students City population: about 355,000 CCTV system served media centers in three high schools (including one parochial), but is no longer being used ITV in individual classrooms now Not core application (used for individual supplementary instruction in carrels of media center)
Portland	State-federal grant to improve education to disadvantaged students used in part for CCTV to nine elementary schools; television programs integrated with regular curriculum; CCTV coordinator appointed; in-service training for teachers (4) District decentralizes, original project discontinued; new coordinator appointed and operation assigned to central media department (3,5) (1967-1973)	Third coordinator appointed, develops ITV; classrooms use VTRs independently; vocational television production program initiated in magnet school; both state and local funds used; in-service training offered (2) ITV system becoming routinized with budget support, equipment updating, service expansion and civil service classifications; television production program now mandated by board of education (1974-		District: about 62,000 students City population: about 380,000 ITV, but no current CCTV system At peak, CCTV covered all classrooms in nine elementary schools; covered regular curriculum

Rochester	State grant for CCTV matched by local bond issue; about 1,300 television sets; operation administered by separate television department with part-time coordinator; takes several years to get all schools wired; contractor provides some initial technical assistance Full-time coordinator hired (1963-1966)	Civil service classifications established for television personnel (5) Fifty-two schools receiving programs; not part of basic curriculum Superintendent and coordinator leave district New coordinator hired Transition to all local funds (2) Much equipment becoming outdated Continued union opposition and budget cutbacks force new superintendent to discontinue operation Television department and staff disbanded Individual schools continue to use CCTV on an intermittent basis (1967-	District: about 41,000 students City population: about 300,000 A few schools use remnants of CCTV system that once served 52 schools Not core application (typing is main subject); always considered a special program Negligible teacher training; CCTV staff mainly recruited from outside district; no provision for equipment depreciation CCTV not integrated with curriculum department

MICU units. The candidates were naturally selected from among the most talented officers; but in addition, the new program deliberately involved officers who had several years' experience in the department (rather than new recruits or those about to retire), so that the paramedic functions would be established at the outset as an important set of activities from the viewpoint of other officers in the department.

These initial practitioner opportunities were merely the beginning of the necessary longer-term support for the innovation by practitioner groups. Even though there was often a "creaming" effect—i.e., the initial participants were the most highly motivated and skilled practitioners—the hope was that practitioner use would spread and implicit support for the innovation would gradually increase.

There were two innovations where, in part because of the nature of the innovation, such a process of practitioner exposure was not entirely possible. In one case, CCTV, the technical requirements for practitioner involvement were assumed to be minimal because television was thought to be an easy technology for most people to use. (It was later found that teachers could even have difficulty in turning on and tuning their receivers.) However, except for Portland, practitioners were not heavily involved in the central planning or implementation of the CCTV operation in the case studies. There was little in-service training for teachers, and the central operation was administered by technicians who were part of a media or television department and who had little contact with the formal school curriculum. As a result, the CCTV system tended to be seen as an outsiders' innovation, one that could even threaten the teachers' role in the classroom. At one site (Rochester), such lack of integration of practitioners into the CCTV operation provided the basis for teacher opposition to the innovation, and the teachers' union argued against the innovation in budget negotiations over a period of years. This opposition eventually led to the demise of the CCTV operation, even though the system at one point had involved television programs being cabled over three channels and into over 1,000 television sets.

The other innovation where it was difficult to develop practitioner exposure was the Jet-Axe. This was because the explosive device is consumed during detonation and costs about $125 per unit. For demonstration or training purposes, fire departments were unwilling to detonate more than a few Jet-Axes. In actual firefighting, the need for the Jet-Axe only arises sporadically (i.e., only in fires where an especially impenetrable door or wall has to be opened). Therefore, even though formal training was widespread—in both Omaha and Rochester the experienced firefighters received instructions as part of their routine training in the firehouse and new recruits received training in the academy—the actual experience with the explosive device was limited to a few firefighters. Unless it is possible to provide practitioners with direct exposure to an innovation—an experience for which classroom instruction or the viewing of a film cannot serve as substitutes—it is difficult to allow practitioners the opportunity to test and improvise, much less to generate support for such an innovation.

Resource Management

To support an innovation, funds were required to purchase or lease the appropriate equipment, to cover staff time to operate the innovation, and to cover train-

ing costs (both the costs of the training staff as well as the time allotted to the trainees). Flexibility and improvisation in the use of available funds were again dominant features of the early period of the innovation in our case studies. In fact, the most important feature was that there were few hard rules regarding the most effective procedures for resource management.

External versus Internal Funds. A pressing policy issue for federal officials has been whether the availability of external funds—provided by federal or state agencies—can facilitate the innovative process. Because this appears as such a crucial issue, Table 7 enumerates the specific case study sites and the use, if any, of external funds to support the Improvisation Stage. (This tabulation is independent of the question of whether the passage to local funding was later achieved or

Table 7

Sources of Funds for 19 Case Studies

Type of Innovation/Site	Main Source of Initial Funds	Additional External Funds[a] before Adoption?	Additional External Funds[a] after Adoption?
Police Computer			
Miami	Local	No	Yes
Indianapolis	Local	No	No
Nashville	Federal	No	No
Boston	Local	No	Yes
Breath Testing			
Cincinnati	Federal	Yes	Yes
Akron	Local	No	Yes
Memphis	State	No	No
MICU			
Dallas	Federal	No	Yes
Birmingham	Federal	No	No
Denver	Federal	No	No
Jet-Axe			
Rochester	Local	No	No
Omaha	Local	No	No
CAI			
Dallas	Local/Federal	Yes	Yes
Oakland	Local	No	Yes
Tampa	Local	No	No
San Diego	Local	Yes	Yes
CCTV			
Omaha	Federal	Yes	Yes
Portland	State/Federal	No	No
Rochester	State	No	Yes

[a]For example, specific projects or equipment purchases that were funded from state, federal, or private sources. These external funds did not provide the dominant support for the innovation, however.

not.) The table indicates the wide variety of patterns for using external funds. In two cases, Cincinnati and Rochester, the innovations were funded with large amounts of external funds as part of high-visibility demonstration projects on breath testing (the Alcohol Safety Action Program of the U.S. Department of Transportation) and on CCTV (a state program to encourage educational applications of telecommunications). In both cases, the site was visited by many officials from other jurisdictions during the first few years of the innovation's lifetime. In other cases, federal or state funds were available as general revenue-sharing funds (e.g., Dallas, MICU) or categorical project funds (e.g., Birmingham, MICU; and Memphis, breath testing). In about half of the cases, however, local funds were the entire source of support, whether from a bond issue (e.g., Miami, police computer) or from an agency's operating budget. Moreover, this mixed pattern was also true of small pilot projects or specific federal projects that may have preceded or followed the adoption of the larger innovation. Typically, these smaller projects were for specific applications of the larger innovation. For instance, in Tampa, specific CAI projects were initiated and completed with funds from the U.S. Law Enforcement Assistance Administration and the U.S. Office of Education (Title III), but these projects were only two applications in the larger CAI system.

Overall, Chapter VII will show that *the availability of external funds was not related to the ultimate outcomes of these case studies—i.e., number of passages and cycles achieved.* There were cases where federal funds were associated with innovations that eventually changed radically (e.g., Portland, CCTV) as well as that grew steadily to a routinized operation (e.g., Dallas, MICU). There were also cases where there were similar outcomes even though one had federal funding and the other did not, a contrast that appeared most strongly for two of the breath testing cases, Cincinnati and Akron.

The reason that the use of external funds did not appear to make a difference in predicting any simple pattern of outcomes was that, where there was a local desire to innovate, the innovators acted in a resourceful manner and sought funds from the most readily available sources, whether external or internal. In most case studies, the funds used to support the initial operation came from more than one source—e.g., more than one local budget category or even more than one local agency. This approach was most easily illustrated by the diverse sources of financial support for the initial training of practitioners. With the two health-related innovations (MICU and breath testing), the state public health agency or a local hospital often performed the training function, with no charge to the relevant fire or police department. In other cases, departmental resources were used to implement on-the-job training or in-service training. In yet other cases, external funds were used either to reimburse the training staff or to cover the work time of the trainees. In all cases, the important objective was simply to establish an initial round of practitioner training, so that some small group of practitioners would be readily available to operate or to use the innovation.

External funds were often used to purchase equipment, which would reduce the initial outlay for the innovation by the local agency. However, even here there was no simple pattern. For computer systems, for instance, if funds for outright purchase were not available, a local agency did not have to rely on external funds but could consider an annual leasing arrangement, a long-term (e.g., seven-year) lease, or a lease-purchase agreement. All of these alternatives were used in the various

case studies. Furthermore, a computer terminal could be considered part of the standard equipment of a school building, and capital funds could be used when a building was being upgraded or a new wing constructed. In fact, the innovator who considered the only option to be a binary choice between external or internal funds severely limited his or her ability to improvise. The skilled innovator could always identify a variety of sources from which funds could be made available.

Managerial and Technical Resources. More important than the distinctions concerning the source of funding was the ability of an innovation to obtain another type of resource: managerial support at the administrative level where resources were allocated, and technical support at the level where the use of specific resources could be monitored. The administrative level involved a top policymaker —city council member, the municipal executive, or an agency head—who could allocate funds for a specific project or purchase. The successful innovation had the support of at least one such policymaker who was willing to take the risks and to approve budget expenditures at the outset, when there was little evidence concerning the potential success or failure of the innovation. This was true, for example, whether the outlays were for new Jet-Axes and were part of the routine purchasing procedures of an agency, or whether the outlays were for a minicomputer that had to go through the capital budget process.

Two other comments should be made about this top policymaker. First, "top" is a relative term. In a decentralized school district such as San Diego, the top policymakers were the principals of each school, as these were the administrators who had to make the key decisions for resource allocation. The innovators and interested practitioners in San Diego correctly concentrated on convincing the principals of various schools to pool their resources to acquire the first CAI computer. In centralized school districts, the appropriate policymaker was at the district, and not the school, level. For computer systems in school districts and police departments, for instance, the head of data processing or of administrative services fulfilled such a role. For other municipal agencies, the top policymaker was the agency head but could also be a person outside the agency. In Dallas, for example, the MICU program was initiated as a result of public and political concern over poor emergency services. The innovation began when the mayor and city council approved a new budget item on behalf of the fire department; the chief of the department, though supportive, did not necessarily play an active role in this major resource allocation decision.

Second, the support of the top policymaker, while necessary, was by no means a sufficient condition for ultimate success. In Rochester, the CCTV system was initiated both because of the availability of state funds as well as the enthusiastic support of the superintendent. In fact, the superintendent not only allocated the necessary resources but also actively used the CCTV system as part of his administrative functions. Nevertheless, the CCTV operation ceased a couple of years after the superintendent vacated his position. Although the presence of a top policymaker's support could not guarantee the success of an innovation, the *absence* of such support did debilitate it. This was especially true in Oakland, where the CAI system evolved without such support and without much central coordination; as a result (and for other reasons to be cited later), CAI was not widely used. In other cases (e.g., Nashville, police computer), lack of support by the agency head was offset by strong support by a deputy head. The main point was that there needed to be active

support by some top administrator, whether an agency head, a deputy, or someone outside of the agency. When support was totally lacking among all these individuals, an innovation was in trouble.

Technical support at the operating level was a necessary complement to the role of the top policymaker. The operating level was where day-to-day decisions regarding the innovation were made, and the required support was much more of an ad hoc nature but the person who worked at this level, usually the coordinator of the innovation, needed to have a cooperative relationship with the top policymaker.

The technical support functions at this level covered a variety of tasks. First, the coordinator had to have immediate access to resources for repairing and maintaining the innovation. Often, this meant that the coordinator had to be able to make instant repairs for equipment malfunctions. CAI, police computer, CCTV, and breath testing equipment specifically called for continual monitoring and maintenance. Where internal capabilities were lacking, an on-site vendor providing service as part of the original purchasing agreement served as a substitute. The vendor needed to be as accessible as possible, however, to avoid long periods of downtime. In several case studies, service representatives of the vendor either routinely contacted the agency on a daily basis or even had a desk in an agency office from which to work. In the cases of the Nashville and Indianapolis police computers, the vendors even assigned full-time personnel to work with the agency. Whether external assistance was used in this manner or not, the supervisor had to be sufficiently skilled and to have a flexible time schedule to attend to any malfunctions immediately.

Second, the supervisor had to estimate the need for supplies and replacement parts, taking special care not to over- or under-order. Here, the relationship with the top policymaker was important, for if the supplies required substantial outlays, administrative approvals had to be obtained without delay. For the Jet-Axe, for instance, it seemed to be no coincidence that in both case studies the head of the agency was both the technical coordinator and the top policymaker. The cost of the Jet-Axe precluded maintenance of a large-scale inventory, and agencies generally kept only three or four extra explosives in stock; when the Jet-Axes were used for training or firefighting, replacements had to be obtained quickly, and the head of the agency was in the best position both to monitor the use of the Jet-Axes and to initiate the new purchase requests.

Third, backup equipment was set aside wherever possible, even if this meant that the innovation did not provide full coverage at the outset. In Akron, although two Breathalyzers were initially acquired, one was immediately defined as a backup for the other; for MICU and CCTV, reserve equipment was essential. For computer systems, however, the core unit could not easily be replaced for repair, and the entire system was sometimes inoperable for the duration of a repair.

Fourth, the supervisor often had to design and initiate the first round of practitioner training sessions and thus had to be able to identify resources to support such sessions. The assistance from other agencies in providing MICU and breath testing training has already been noted. In relation to other innovations, however, the burden of developing the curriculum, scheduling the training sessions, and locating funds to pay for trainee work time all fell on the shoulders of the supervisor. In several CAI innovations (e.g., Tampa, Dallas, and Oakland), the first round of practitioner training was organized on an informal basis and was not integrated

into the formal in-service training curriculum. Such integration, if it was to occur at all, occurred during the later periods of the innovation's lifetime. During the Improvisation Stage, the main task was merely to organize and conduct an initial round of training.

In general, competent resource management involved a cooperative relationship between a top policymaker who controlled agency resources and a technical supervisor who dealt with the innovation on a daily basis. In some cases, these two roles may have been performed by the same person, whereas in other cases the roles may have been divided between the head of an agency (or even someone external to it) and a line officer in charge of the innovation. Both roles were important. One was needed for access to significant agency resources that required extended budget justifications and a certain amount of risk-taking in allocating resources before an innovation had a chance to prove itself; the other was needed so that these resources, as well as others that could be obtained from existing equipment pools and excess inventory items, could effectively serve the daily needs of the innovation. Once again, the key ability in performing these tasks was improvisation—to find the resources to maintain the innovation. During this early period, the innovation was kept operating at some visible level as much as possible, even though the outcomes were not yet assessable.

Nature of the Innovating Team

Previous research has repeatedly emphasized the importance of an active, dynamic, and charismatic person to serve as an innovator. However, the case studies showed that such a single person was not a necessary figure for most innovations. When respondents were asked to identify the person or persons who actively initiated support or put together the main elements for operating the innovation, the response was frequently more than one individual. As suggested by the discussion on resource management, although there were a number of specific functions that had to be served by a person involved with the innovation, these functions did not have to be served by the same person. These functions included:

- Understanding the needs of an innovation and taking the initiative to identify and allocate specific resources for the innovation (this initiative may be taken by someone inside or *outside* of the agency).
- Coordinating the use of the innovation with existing procedures and practices (e.g., designing practitioner training, developing relevant applications for the innovation, or integrating new vehicles or equipment with existing facilities).
- Technically mastering the innovation, whether for instructing others or for maintaining the operation of the innovation.

To this extent, the case studies revealed a much richer and detailed description of the innovative role than the stereotypic "charismatic and hardworking" person.

Table 8 identifies the person or persons associated with these innovative functions. The table shows that only in a few cases was the innovator a single individual. In most cases, there was an innovation team, although this does not imply that the team members made explicit alliances. For instance, for MICU, where medical expertise had to be combined with the functions of the fire department, it was

Table 8

Innovators Identified for 19 Case Studies

Type of Innovation/Site	Persons Identified with Innovator-Functions[a]			
	Person(s) outside Agency	Head of Agency	Deputy Head or Other Major Bureau or Division Head	Official(s) within Agency
Police Computer				
Miami	✓	✓	✓	
Indianapolis		✓	✓	
Nashville	✓✓			
Boston		✓	✓	
Breath Testing				
Cincinnati			✓	✓
Akron		✓	✓	✓
Memphis	✓			✓
MICU				
Dallas	✓✓			✓
Birmingham	✓		✓	
Denver	✓			
Jet-Axe				
Rochester		✓		
Omaha		✓		
CAI				
Dallas				✓✓
Oakland				✓[b]
Tampa				✓✓
San Diego		✓[c]		✓
CCTV				
Omaha	✓			✓
Portland				✓
Rochester		✓[b]		

[a] Each ✓ = an individual.

[b] Difficult to identify any innovator.

[c] Heads (principals) of decentralized units with full control over resource allocation.

essential in all cases to have some medical advisory committee or local hospital official working as part of the innovation team. This group or individual guided the technical implementation of the MICU units, arranged for paramedic training for fire officers, and developed the communication system between the fire department and the emergency medical facility. The presence of such a group or person is indicated by the check marks in the first column of the table. (In Denver, the external official actually dominated to the extent that fire officials played a passive role in the innovation.)

In most cases, an innovation team was composed of a top policymaker and a technical operator, whose roles have been described in the previous section. For police computers, an official external to the agency (e.g., the mayor and a council member in Nashville) sometimes played the former role, while a deputy chief or division head played the latter. For CAI, the top policymaker was usually the director of the data processing section who made the major acquisitions and established the initial applications, whereas the technical operator was another official within either the curriculum department or the data processing section. (This combination is indicated by the double check marks for Dallas and Tampa in the last column of Table 8.) In a small number of cases (Denver, MICU; Omaha and Rochester, Jet-Axe; Oakland, CAI; and Portland and Rochester, CCTV), the innovator was either a single individual or nonexistent.

The innovating role was a critical one, whether served by an individual or by a group. This was because the innovation was bound to encounter serious problems that could not be anticipated, and knowledgeable and resourceful individuals often had to be available to make fast, on-the-spot decisions. Until such problems had been encountered several times apiece, they could not be treated routinely; thus, it was best if there was little turnover among the incumbents who filled the innovator roles. Modified service applications, new equipment, and procedural changes could be implemented and monitored only if there was some continuity among the members of the innovation team. This need for continuity led to an important observation: When the Improvisation Stage for an innovation extended beyond the average period of an incumbent's tenure, leadership turnover was likely to occur, thereby creating difficulties for the innovation. An example was the highly qualified agency official, who might have remained in a specific position for only three years before being promoted; similarly, the terms of most elected officials usually did not exceed four years. From this perspective, the most easily incorporated new technology should probably require an Improvisation Stage of not more than two or three years.

Strategic Choices

The activities during the Improvisation Stage were guided by three strategies that appeared to be associated with case studies whose innovations later achieved more passages and cycles. These strategies were to maintain a narrow initial scope for an innovation; to deliberately and carefully eliminate the traditional practice, if any, displaced by the innovation; and to reduce the job threat to practitioners in using the innovation.

Scope of an Innovation. The previous sections have identified the need to avoid as much downtime as possible and to minimize the Improvisation Stage to two or three years. Both of these objectives were more easily served if the innova-

tion had a narrow scope during this period. Narrow scope implied that the innovation was not used for all the possible applications or implemented for all the relevant districts in an agency.

In two cases, for instance, the operation of MICJ (Birmingham and Denver) began with a single vehicle. In the third case, the innovation began with several vehicles, but followed a deliberate, two-phase plan in which basic transport service (which was not previously provided by the agency) was first implemented, and paramedic services were then added about a year later. Similarly, even in the most successful cases, the breath testing innovations were initiated on a subdistrict basis; only later was the innovation applied throughout the department.

For computer systems, narrow scope implied a limited number of applications as well as the selection of those applications that were easy to implement. The early applications of police computer systems, for example, included the automation of reported crime data and the storing of records for outstanding warrants, traffic violations, and stolen vehicles. Only later was it advisable to add records for stolen property, criminal histories, or even the department's own property management and personnel records, all of which involved much larger and more complex information bases. Naturally, individual police departments varied in the degree to which each of these files, previously maintained by manual entry and sorting, was suitable for automation or involved officers who would resist the use of the computer. The key task was to identify those files that had been adequately maintained manually, that were not difficult to transfer to computer formats, and that were under the supervision of a cooperative official, and to avoid those files that had the opposite characteristics. Such a strategy was followed in most of the case studies where, for example, the more difficult applications such as computerized dispatch, case entry, or criminal history systems did not appear until later, if at all.

There were several benefits from maintaining a narrow scope for the innovation. With a narrow scope, the innovation was more likely to be operated at a steady pace. The innovation was also not likely to overextend its resources or the capabilities of the innovator and technical staff in charge of maintaining the innovation. However, there was a psychological payoff as well. If narrowly defined, an innovation could be more quickly labeled as functional than if it were broadly defined. The Rochester CCTV case provided a negative illustration of this point: The CCTV system was defined so ambitiously at the outset that numerous schools and classrooms were included in the anticipated coverage. After three years from the start of a five-year grant, only 60 percent of the classrooms had even been wired; after four years, it was 90 percent. The innovation was thus still not fully operational after several years. Moreover, the major effort during this long period of time went into the physical implementation of the system, thereby potentially drawing resources away from other essential activities such as practitioner training or the integration of specific television programs into the formal curriculum. In contrast, an innovation whose scope was narrowly defined could initially consolidate support and later expand to other activities or subdistricts, which was the pattern followed by most of the successful case studies.

Deliberate Elimination of Superseded Procedures. This second strategy was often overlooked. Innovators attended to the development of new practices in relation to an innovation, but they forgot that conversion was facilitated if the superseded practices were simultaneously eliminated. With computer systems, the

replacement-elimination procedure was perhaps best known. After a computer file had been established and provided information reliably, the old manual files could be destroyed. If the manual files were allowed to be maintained in parallel with the computer system, they could certainly serve as a backup system; however, their preservation also remained a threat to the routinization of the new computer system.

The elimination of superseded practices required a deliberate effort and did not automatically follow the installation of new practices. For instance, all innovations required new organizational procedures that were reflected in the use of new forms (e.g., data entry forms, case report forms, or other organizational forms). When the new forms were satisfactorily being used, a few innovators systematically discarded the old ones. In Indianapolis, as new applications were automated and new forms created, specific orders were given: (a) to destroy the old forms still in inventory and (b) to cease printing the old forms. This was an explicit action that prevented the staff from returning to the previous practices. Similar actions included the removal of old equipment or the reassignment of specialized personnel associated with the superseded practice. For example, breath testing innovations usually displaced traditional urinalysis procedures. Because breath testing did not require a chemist (which urinalysis did), the assignment of other responsibilities to the chemist made it more difficult for an agency to revive the urinalysis procedure on a full-time basis. In the long run, an effective displacement tactic was to encourage sufficient turnover among operating personnel so that few could recall how to carry out the superseded practice; alternatively, an ethos could be developed whereby few individuals desired to revert to the old practice.

Naturally there were some innovations such as the Jet-Axe that actually represented "add-on" services, and where no existing practice needed to be displaced. In these cases, the elimination procedures were not relevant but other factors, especially the one discussed next, became more important.

Reduction of Job Threats to Practitioners. The importance of practitioner exposure has already been emphasized. For any innovation, practitioners need to gain direct experience in using the innovation. They need to understand its capabilities and implications for their everyday behavior and, in particular, to develop confidence that the innovation will not be a long-term threat to their jobs.

Many technological innovations for public services have, in fact, been promoted by federal agencies partly on the basis of potential job savings or reductions. The early development of CCTV and CAI, for instance, assumed the major payoff to be the provision of more individualized instruction for each student. This was presumed to relieve a teacher from spending too much time with a given student on tasks, such as drill-and-practice, that were valuable to the student but time-consuming to the teacher. In the short run, specific teaching jobs were not necessarily threatened; however, in the long run, these technologies could be interpreted as displacing the need to add new positions. Not surprisingly, teachers initially viewed CCTV or CAI with skepticism. Any such skepticism was overcome in the case studies wherever teachers had ample opportunities to use the innovation (e.g., Dallas, Tampa, and San Diego, CAI; and Portland, CCTV). The teachers found that the innovations really did not displace their work but actually increased demands for their time and made some of their tasks easier. For instance, the major CAI application was the initiation of *new* courses—computer programming and ad-

vanced computer science. The expanded curriculum meant greater demands on teaching time (and potentially *more* jobs). Moreover, in some of the courses, enthusiastic students developed programs to assist teachers in their regular mathematics courses. For instance, in one case study, advanced mathematics students wrote programs that altered the numbers for different problem sets, so that a teacher could have multiple versions of the same test. The teacher could then administer these versions to the same class and thereby reduce the opportunities for cheating, which had become an increasing problem. In fact, the successful use of CCTV and CAI generally expanded the teachers' resources, and these innovations did not necessarily reduce the need for teaching time. This observation may disappoint those policymakers who might have expected innovations to produce savings in manpower. However, the important point is that local innovators should strongly encourage practitioner use of the innovation, so that practitioners can learn about their own benefits from the innovation.

Some innovations, of course, actually displaced practitioner time. This was especially true of breath testing operations. Under the traditional urinalysis procedure, an officer had to spend many hours on a single DWI suspect. The suspect would have to be brought into the station to produce a urine sample, during which the officer was required to be present to observe the sample being given in order to prevent fraud (for female suspects, a matron had to be employed for the same purpose). The officer then had to deliver the specimen to the city laboratory, fill out the appropriate forms, and appear in court. The use of the Breathalyzer, whose test only takes a few minutes and entirely replaces the need for the trip to the city laboratory, markedly reduced the amount of officer time *per DWI case*. The innovation was thus a timesaving device and could, in theory, threaten job positions in the long run. However, this was not the outcome in any of the case studies, because the new convenience in using the Breathalyzer encouraged officers to make *more* DWI arrests. Although officers spent much less time per DWI case, they initiated many more cases. As a result, an officer could actually spend more time in court and away from patrol, a situation that even led to officer complaints about downtime at one site (Cincinnati). Nevertheless, the point is that even a timesaving innovation, especially if it eliminated duties that were unpleasant or boring, did not need to threaten jobs. The innovation could result in increased efficiency and thereby lead to new service applications or demands that more than offset the initial time saved. Acceptance of the innovation, however, was strongly facilitated by encouraging direct exposure and experience to the innovation on the part of practitioners.

Finally, some innovations were add-on services because they created new demands for practitioner time or skills without displacing any traditional practices. In such situations, encouragement of practitioner use helped to demonstrate that the innovation could actually preserve jobs in times of budget cuts. This was true in both MICU cases (Dallas and Birmingham) that ultimately became more routinized, where both fire departments averted budgetary cuts affecting all municipal agencies because of the added function. The installation of MICU services had increased the number of calls for the fire department and had given the officers an additional responsibility that the community valued. The Jet-Axe was also an add-on service—i.e., the traditional methods for breaking into a structure could not (and should not) be displaced. Because the Jet-Axe did not displace any previous practice, an innovator could not follow the strategy of eliminating the agency's

ability to perform the previous practice. However, because the Jet-Axe was only used infrequently, practitioners could not gain much direct experience in using the innovation. Such conditions made it much more difficult to incorporate the innovation.

Summary

In summary, the Improvisation Stage marked the beginning of an innovation's life history. The decision to adopt the innovation occurred before the Improvisation Stage actually began, and hence has not been covered by the discussion. Instead, the aggregate pattern from the case studies has suggested some of the features of the Improvisation Stage: the need to expose practitioners to the innovation, the need to keep the innovation operating as consistently as possible, and the need for flexible management of resources. For all these requirements, it was important that the persons directing the innovation simply accomplish the tasks and be able to make on-the-spot decisions; it was not necessary for formal organizational procedures to be established or for major organizational changes—e.g., passages or cycles—to be made. These latter objectives, however, did increase in importance during the next two stages in an innovation's life history, as covered in Chapters V and VI.

Chapter V

LIFE HISTORIES, STAGE 2: THE EXPANSION STAGE

This middle period in the life of an innovation presented the first critical tests for routinization. Whereas the Improvisation Stage had been marked by activities associated with the initial operation of an innovation, no organizational *passages* or *cycles* had been required. In contrast, the Expansion Stage, as revealed by the case studies, included several critical passages and cycles; these involved the formal integration of the innovation into an agency's regular organization and procedures. For specific life histories, some of these passages actually occurred in the Improvisation Stage, and others were delayed until the final period in the life history. The main point was that for any given case, *some* passages or cycles needed to be achieved during this middle period.

The most appropriate types of passages or cycles for this middle period appeared to be those that could be accomplished within a brief organizational time span—e.g., less than a year. For instance, the development of new maintenance and supply procedures to serve an innovation could occur in most agencies within a few months. In contrast, a change involving a new training component in a police academy took more time to implement because the change had to be planned and approved, and then had to await the appropriate academic cycle before being initiated. The Expansion Stage, then, was marked by passages and cycles related to the continued growth of the innovation (e.g., the installation of a new generation of equipment), as well as to those that could organizationally be achieved quickly. Although it was still important for an innovation to remain operational throughout this period, the main attention of those supporting the innovation shifted from operational to organizational concerns. In short, there were several passages and one cycle that were generally achieved, and the Expansion Stage was thus characterized by the following types of events:

- Increases in the number and scope of applications involving the innovation.
- Equipment turnover and updating (cycle).
- Transition from external to internal funding and budgetary support for the innovation (passage).
- Formal changes in the organizational identity of the innovation (passage).
- Development of stable arrangements for the maintenance and supplies needed by the innovation (passage).
- Initiation of internal personnel classifications or certification procedures to cover the new specializations associated with the innovation (passage).

The first type of event was the occasion for developing further support for the innovation and identifying potential service payoffs from it. The last five types represented five specific passages or cycles.

Increases in the Number and Scope of Applications

Most of the innovations in the case studies began by operating at a level less

than their full capability. Most commonly, an innovation was applied to some subpart of an agency's operations to see whether it would first work on a smaller scale, and if so, expansion to all parts of a district or department generally followed. As pointed out in the previous chapter, a narrower scope was probably even wise at the outset. During the Expansion Stage, however, the innovations were extended and made available to all parts of the organization. Thus, where a breath testing or MICU system had only been operating in one of several subdistricts, the expansion (even if phased over a period of time) eventually covered all subdistricts. In Cincinnati, for instance, such expansion not only took the form of coverage for all subdistricts; the number of officers being trained as breath testing operators was also increased so that the officers in other parts of the department, and not merely in the traffic section, could use the breath testing equipment and follow the full procedures for processing DWI cases. If such extension did not occur during this stage, the innovation was more likely to be considered a special project of some sort, and this reduced the chances for routinization.

There were at least two other ways in which an innovation's scope could be expanded. The first was applicable to all types of innovations: Once the initial procedures and applications had been established, the innovation could be used by agencies or parties outside the host agency. Thus, in Indianapolis and Nashville, the police computer systems were used by other criminal justice agencies in the metropolitan area besides the police department. (In Indianapolis, one computer terminal was programmed to provide only crime analysis data and was actually used by neighborhood groups in conjunction with the city's neighborhood action program.) Similarly, other jurisdictions used the Akron breath testing equipment and shared the terminals in the San Diego system; for MICU, other agencies began to use the Dallas training program (and were charged for the training costs); and in Birmingham the fire officers began a wide-scale citizen training program for cardiopulmonary resuscitation, a technique that went beyond the standard notion of basic first aid. The use of the innovation by outside agencies and parties served several important purposes: Service demands for the innovation were increased; a broader base of support was developed; and the innovation itself began to be perceived by others as an integral function of the host agency.

The second way of expanding an innovation was more applicable to those innovations that have been labeled as "functionally flexible" (see Chapter II). For police computer and CAI systems in particular, once the initial applications had been successfully adopted, the computer system was then expanded and applied to other aspects of the agency's operations. In Miami, Indianapolis, and Boston, for instance, computer-assisted dispatching was a new application being installed at the time of the case study. This new application was more complex than earlier ones; however, the computer staff was mainly able to cope with the new application because of its experiences with earlier ones. The Dallas and San Diego CAI systems were likewise continually expanded to include new curriculum subjects and hence new groups of teachers and students, but this was not the situation in either Oakland or Tampa. In theory, such expansion to new applications was also relevant for CCTV and MICU systems, which have been defined as functionally flexible innovations. None of the innovations was able to accomplish such expansion in the CCTV case studies, however, in part because of the difficulties encountered with the first set of applications. The only exception was in Portland, where the applications

for using classroom television increased—but in the context of a new instructional television (ITV) system that happened to displace the original CCTV system. Except for the expansion in Dallas and Birmingham already cited above, the basic innovation in the MICU systems was not as functionally flexible as the other types of innovations.

Once again, the Jet-Axe stood out as the single innovation that was so limited in its use that neither an expansion in scope nor in type of application occurred. Given the functional rigidity of the innovation, the only feasible goal at any site would have been to increase the use of the Jet-Axe in firefighting situations, so that more firefighters could gain direct experience with the innovation. However, the actual frequency of application had leveled off in both Jet-Axe case studies.

In summary, increases in the number and scope of applications provided important opportunities for expanding the support for an innovation. The support was a result of additional clients or practitioners having the opportunity to use the innovation, as well as the identification of new service benefits beyond those, if any, associated with the initial round of applications. Together with the activities during the Improvisation Stage, the expansion in scope of applications thus formed the context within which several key passages were to be made. Five such passages or cycles are described in the remainder of this chapter. For each of the five, the discussion leads to a summary status list, indicating the actual status of each case study for the particular passage or cycle. (The entire list may be found in Table 9 at the end of this chapter.) As previously noted, the descriptions reflect the aggregate pattern among the case studies (based on the summary table of events in Table 6 in the previous chapter), and specific passages or cycles for specific cases may have occurred chronologically earlier or later; these deviations, however, did not alter the conclusions to be drawn about the general life history patterns.

Equipment Turnover and Updating

Many innovations provided opportunities for expansion in relation to the updating and acquisition of specific pieces of equipment. Equipment turnover therefore served as an appropriate cycle in making progress toward routinization. Naturally, efforts had to be made to gain administrative support to update existing equipment or to acquire new pieces; but once such support had been generated, and once the acquisition procedure had been used for one or more generations of equipment, the very *practice* of updating equipment became an integral part of an agency's operations.

No innovation facilitated the equipment turnover process more than computer systems, whether for police or for school use. All police computer systems in the case studies went through at least two and sometimes three or four generations of core computer equipment. Such changes usually relieved increasingly competing demands for computer time and were also linked to advances in the state of computer technology. Typically (but not always), the first generation of computers used by an organization had a small memory capacity and was only able to accommodate batch processing (e.g., an IBM 1401); the second and third generation computers had larger memory capacities and were able to accommodate batch and on-line processsing (e.g., IBM 360 and 370 systems); and the fourth generation involved the acquisition of separate core computers for specialized functions (e.g., minicomputers for message switching or for computer-assisted dispatch). By this definition of

equipment turnover, the Nashville and Miami police computer had used two generations of computers; Boston, three; and Indianapolis, four. For the core computers in CAI systems, Oakland, Tampa, and San Diego had all implemented only one generation of CAI applications (though the computer system was in a later generation with regard to administrative applications), and Dallas, two. Thus, the CAI systems had not involved as many equipment cycles as their police counterparts.

In on-line computer systems, the terminals could also be updated as a result of increased demands and improvement in the state of the technology. Such turnover was difficult to assess because an agency was unlikely to change all its terminals at the same time; however, in a few cases (Indianapolis, police computer; San Diego and Dallas, CAI), significant numbers of new types of terminals had been acquired following the initiation of the computer system. For San Diego, the turnover in terminals had compensated in part for the lack of turnover in the core equipment, so that both the Dallas and San Diego CAI systems may be regarded as having fulfilled a prime requirement of the Expansion Stage, whereas the Tampa and Oakland CAI systems did not.

Innovations besides computer systems provided a more limited opportunity for equipment upgrading and turnover. In theory, CCTV systems could involve updating of receivers as well as recording and transmitting equipment. More efficient portable television cameras, for instance, have been continually developed and could be among the new equipment to be included for a CCTV system. However, because two case studies (Omaha and Rochester) did not survive their initial difficulties, such updating never became an issue; in Portland, updating did occur to a limited extent but the CCTV system was converted to an ITV system, and for the purposes of this study did not qualify as a turnover in equipment. Similarly, MICU systems could also be subject to updating. New generations of vehicles were possible, as were changes in the life-support equipment carried within the vehicle. Such updating did occur in both Dallas and Birmingham; the latter involved the acquisition of a new generation of monitoring and telecommunications equipment (i.e., Life-Paks).

For the other technologies, breath testing equipment and the Jet-Axe, no updated versions of equipment were relevant (although there were new models with minor modifications). The original equipment was generally suited to serve any expansion in service needs, and few improvements had occurred in the state of the technology. However, for such innovations, new equipment was nevertheless acquired in the form of additional units. Thus, in Cincinnati and Akron, purchases of new Breathalyzers occurred in the Expansion Stage, even though these new units were virtually identical with the original models. The new units were used to replace the older ones, which in turn were used for backup or training purposes. Similarly, the Memphis breath testing operation involved successive purchases of new equipment and the original equipment was eventually traded in for credit toward those purchases. For the Jet-Axe, additional purchases were also made several times in the years that followed the initiation of the innovation. For the breath testing and Jet-Axe innovations, the new acquisitions thus performed the same function of establishing the *practice* of updating equipment, even though the equipment itself did not represent a technologically new generation.

Table 9 includes a summary of the status of each case study for this first cycle. Wherever a new generation of equipment was installed, or wherever at least one

sequential purchase of similar equipment was made, the case study was regarded as having achieved this particular cycle. (This table should also be referred to for summary tabulations for each of the remaining passages in this chapter.)

Transition from External to Internal Budgetary Support

No passage has received more attention from federal policymakers than the transition from external to internal funding. Many federal policymakers have viewed the transition from soft to hard money as the major sign that an innovation has been routinized. Thus, the transition has been interpreted to mean that a local agency will support an innovation on a lasting and permanent basis. The transition appears appropriate for the middle period of a life history, because if there have been external sources of funding, such funding generally expires after three to five years, forcing a local agency to face the decision concerning local funding. However, the case studies indicated that this transition, although important, was only a part of a much more complex set of organizational changes. In other words, transition from soft to hard monies may have been a necessary but was not a sufficient condition for routinization. The other passages and cycles covered in this and the following chapter appear just as important to any operational definition of routinization.

It has already been noted that local funding support occurred at the outset in at least half of the case studies (see Table 7 in the previous chapter) but that such support was not correlated with the ultimate success of the innovation in achieving passages and cycles. For those innovations that had been externally funded at the outset, all but one (Denver, MICU) eventually made the transition to internal funds. Thus, the costs of staff support, expenditures for supply and maintenance, and the acquisition of new equipment were all ultimately supported in some way out of an agency's own budget. In two cases (Nashville, police computer; and Dallas, MICU), the transition was made easier by the fact that the external funds (from LEAA in the first case and from general revenue-sharing in the second), had not ever been specifically identified as a separate part of the agency's budget; administratively, the expenditures for the innovation had been incorporated from the outset into the agency's regular budget, with the knowledge that the overall city budget was being reimbursed from an external source. This procedure helped to prevent the innovation from becoming overly identified as an externally funded project, even though in one case (Nashville) the external funds were part of a long-term, five-year grant.

Regardless of the budgetary mechanism, however, the main point is that all but one of the innovations in our case studies eventually received full local budgetary support. Such support tended to occur early in the life of the innovation (in many cases, during the Improvisation Stage) but did not preclude subsequent budget cuts or even the cessation of the innovation. The three CCTV experiences may be most instructive in illustrating the reasons why the transition to hard money was not a sufficient condition to assure routinization.

In one case (Portland), a district-wide decentralization occurred after the CCTV innovation had been initiated. The original CCTV system had been organized on a centralized basis, and television programs had been transmitted to nine schools whose students had been predominantly from low-income families. In the decentralization, these nine schools became parts of different subdistricts, and each

subdistrict had enough autonomy to determine its own priorities; the CCTV system was not sufficiently important for any single subdistrict to maintain the full system. As a result, even though the CCTV system was being supported by local funds, the innovation actually changed to an ITV system, whereby individual teachers could use over-the-air programs or videotapes for viewing in the classroom, but there was no transmission of programs from one classroom to another or from one school to another. Furthermore, a television production project was developed as part of a high school vocational education curriculum, in which both state and local funds were used. The ITV system was thus more compatible with the decentralized organization of the Portland school district than was the original CCTV system. Changes in the innovation occurred, in short, independent of whether the innovation was supported by external or internal funds.

In Omaha, the CCTV system was originally supported by a federal grant and local funds were then used when the federal grant expired. The system, however, had encountered a series of difficulties throughout its Improvisation Stage, including technical difficulties in installation, early turnover among key CCTV staff, and delays in obtaining FCC approval to use certain channels for transmitting the digital signals needed to summon a television program. Moreover, the CCTV applications had not been highly integrated with classroom teaching; the main application was the installation of special carrels in the media centers of three schools, so that students could view television programs as a supplement to their classroom instruction. As a result, few students or teachers came into contact with the system. Those that did often encountered a system that was not functioning properly. Local funding for the project ceased when, under constrained budgetary conditions, the school district decided to use its resources to upgrade a television studio that had become part of the vocational education curriculum. The CCTV system thus had not achieved sufficient priority to avoid being affected by budgetary cutbacks.

In Rochester, the initial support for the CCTV system came from both state funds and a local bond issue. The proportion of state funding systematically declined over a five-year period, and when the state funding was terminated, the entire system became locally funded. The initial conditions in Rochester were more auspicious than those in Omaha. The system was technically sound, reached numerous classrooms, and was strongly supported by the school superintendent. Nevertheless, under similar subsequent pressures to reduce budgets, as in Omaha, the CCTV system was discontinued. This appears to have been attributable to several factors: The CCTV system had not been used for core curriculum subjects (typing was the main subject); it had aroused practitioner and thus union opposition because it appeared as a job threat; it had not adequately accounted for the rapid depreciation of the television equipment; and the supportive superintendent was replaced. Moreover, observers at the site noted that the Rochester system had been initiated at an early time (in the mid-1960s), when there were few attractive educational television programs such as "Sesame Street" or "The Electric Company."

It may be argued that these case study experiences were inadvertently affected by the peculiar budgetary trends that have existed for the last 20 years. During this time, most local agencies first experienced significant budgetary growth, which was then frequently followed by severe cutbacks. The argument could be made that these conditions have made hard funding an exceptionally vulnerable characteristic; that under normal conditions of less rapid growth and contraction, the transi-

tion to hard money would be sufficient for routinization. The case studies suggest otherwise. They suggest that, on the contrary, budgetary cutbacks provided a strong and important test for routinization: If an innovation had become truly routinized, it should have achieved a sufficiently high priority to withstand even severe cutbacks. This was certainly the experience in several case studies, where police computer systems (e.g., Miami, Indianapolis, and Boston), breath testing (e.g., Memphis and Akron), and MICU systems (e.g., Dallas and Birmingham) all survived budgetary cutbacks. Although operations were reduced in other agencies, or even in the same agency, the innovation remained largely unaffected.

In summary, local funding was an important early step in the routinization process. However, routinization requires an innovation to survive other organizational passages and cycles in addition to the transition to hard money (see Table 9).

Formal Changes in the Organizational Identity of an Innovation

A third way in which organizational integration occurred was for an innovation and its staff to become a part of the appropriate organizational unit with an agency. Achievement of such organizational status was necessary if the innovation was ultimately to disappear as an innovation and to become part of "standard practice." Moreover, the creation of such organizational status frequently occurred when the innovation was initiated, so that the passage should at least have occurred during the Expansion Stage. However, the attainment of various organizational arrangements was a difficult transition to assess. The difficulty stemmed from the fact that there were at least four possible organizational arrangements:

1. The innovation became the basis for a new unit that *did not* achieve formal recognition as a standard organizational unit but remained a "special project."
2. The innovation became the basis for a new unit that *did* achieve formal recognition as a standard organizational unit.
3. The innovation became a formal responsibility of an existing unit or agency official who served as coordinator.
4. The innovation had no organizational status and no special coordinator.

The first problem was that, although the least desirable outcome for any innovation was to remain a "special project," it was often difficult to distinguish such status from the second organizational arrangement listed above—i.e., formal recognition as a standard organizational unit. Agencies had different procedures for making formal organizational changes, and some of these changes were artifactual (i.e., in name only) and were reversible. Nevertheless, no matter what procedures were involved, it was important for an innovation to avoid "special project" status after the Improvisation Stage; again, the best examples of this shortcoming were the CCTV innovations in Rochester and Omaha, where there were no formal changes and where practitioners and administrators perceived the CCTV systems as special projects that were not part of the core organization. In Rochester, a formal television department had actually been created to administer the CCTV system but was later disbanded.

A second problem was that different organizational arrangements were relevant for different innovations, depending upon the type of innovation and how it

was used at a particular site. For breath testing, for instance, the appropriate arrangement was probably the integration of the innovation into the responsibilities of an existing unit, the traffic bureau or section. This was because the breath testing innovation was intended to displace an old function (urinalysis) and was therefore located in the same organizational unit that had administered the old function; this was indeed the experience in two of the case studies on breath testing. In the third case (Memphis), however, a separate city-county unit had been established because the innovation served both the city and the metropolitan area; officers were assigned from both the police and the sheriff's departments to serve in this hybrid unit. Although adoption may have been made easier by developing a hybrid unit, and although the old function had been displaced, this organizational arrangement was now potentially vulnerable to problems in either the police or the sheriff's departments, and hence the appropriate passage was not regarded as having been fully achieved. In both Jet-Axe case studies, the innovation also provided an alternative to an existing function (the use of crowbars and axes) and was therefore organizationally placed at the same level, which involved practitioner adoption and use but no formal organizational unit; because the innovation created no new administrative demands, no formal coordinator position was needed.

Police computer systems, however, involved sufficient new equipment, skills, and procedures that a separate organizational unit appeared to be more appropriate. The formation of such a unit occurred in all four case studies on police computers (and generally occurs in relation to the administrative functions of school computers). With MICU systems, the organizational issues were more complicated. MICU may be administered as a separate service within the fire department, in which case a separate organizational unit, such as the ambulance division in Dallas, appeared appropriate. MICU may also be administered, however, as a service provided within the context of existing ladder and engine companies, in which case integration into an existing organizational unit, as in Birmingham, was more appropriate.

For educational innovations, the problem of organizational arrangement raised an extremely sensitive issue. To the extent that both CAI and CCTV systems were considered innovations that would help classroom teachers, there needed to be some organizational integration of these systems into the central curriculum department of the school district. A CAI system, for instance, may be totally administered by the curriculum department, with technical assistance from the data processing unit (which was usually part of the district's administrative services). At a minimum, the CAI coordinator was frequently a member of the curriculum department, and not merely a member of the data processing unit. The reasons for such a close association were that lasting modifications in the curriculum, which mean the adoption of new practices and changes in the definition of what constitutes the core curriculum, appeared only to occur (but were not guaranteed) when the curriculum department had sanctioned the change and given it a high priority. In this regard, the four CAI case studies varied considerably: The San Diego and Tampa systems succeeded in integrating CAI with the curriculum department; Oakland had not; and Dallas had appointed a mathematics coordinator in the curriculum department and was also in the process of making the overall CAI coordinator a part of that department. The innovation was actually in a problematic situation in Oakland because CAI had no organizational status, even as a special project, nor was there any formal CAI coordinator.

In summary, formal changes in organizational identity were important to the long-term survival of an innovation (see Table 9). Though such changes were difficult to assess, the following points appeared to be the most relevant:

- Identity as a "special project" was curtailed as soon as possible after an innovation had been initiated.
- The appropriate organizational arrangement for innovations that displaced older functions was integration into the existing organizational unit that administered the older function.
- The appropriate arrangement for innovations that provided new functions was the creation of a new organizational unit.
- For educational innovations that attempted to change classroom instruction, direct integration of the innovation into the curriculum department of a district was an important passage.

Stable Arrangements for Maintenance and Supply

Most of the innovations required some maintenance or supplies to keep the innovation operating. Maintenance involved routine preventive care and cleaning as well as the specific repairs needed by a piece of equipment. The supplies were the consumable items (e.g., special paper for computer systems, drugs for an MICU kit, or chemicals for a breath testing device) that were an integral part of the innovation, and an agency had to make some provision for keeping such supplies in its inventory.

During the Improvisation Stage, the point has already been made that part of the innovator's key responsibilities was to insure that appropriate maintenance and supplies were available, whether through an outside vendor or through direct assistance by a person inside the agency. However, the main accomplishment during the Improvisation Stage was to keep the innovation operating, no matter what ad hoc procedures had to be used to obtain the necessary maintenance or supplies. In contrast, during the Expansion Stage, the procedural or organizational aspects rose in importance; the goal was not only to keep the innovation operating but also to establish a dependable procedure for providing maintenance and supplies. The procedure did not take a long time to establish, and hence the transition was best handled during this part of an innovation's life history, although individual cases again varied.

Stable arrangements for maintenance and supply still frequently required outside assistance from a vendor or service company. Such assistance, however, was now part of a long-term arrangement that was not just linked to the initiation of the innovation. A typically unsatisfactory arrangement, in contrast, was one in which the service contract was for a relatively short-term—e.g., a one- or two-year "shakedown" period, with no assistance planned beyond that period. Alternatively, some stable arrangements were entirely based on internal resources, meaning that the maintenance responsibilities were assigned to some unit inside the agency (generally but not always the maintenance shop), and that supplies were acquired through the regular purchasing practices of the agency.

The development of internal capabilities was preferable over continued reliance on an outside vendor. However, certain types of innovations could only rely on long-term service agreements with external sources. Computer systems, for

instance, presented the clearest case for continued external assistance. Whether the core computer had been purchased or leased, most local agencies did not have the capability for repairing computer equipment, and service contracts of some sort (e.g., as part of the leasing arrangement) had to be negotiated. Thus, in all case studies involving CAI and police computers except for Miami, the routine use of such service contracts was evident. Some contracts covered the computing equipment; other contracts were with the telephone company and covered the maintenance of the lines connecting various terminals with the core computer. In all cases except Miami, the expenditures for the service contracts became readily accepted as part of the regular costs of operating the innovation, and the item was rarely questioned in budgetary reviews. (In Miami, a major new generation of computer equipment had just been installed, and the service was still part of the initial installation agreement; however, there was no reason to believe that a satisfactory long-term arrangement would not emerge.) For computer systems, then, the development of long-term service arrangements with outside vendors (even if renewable annually) constituted the appropriate passage for maintaining and supplying the innovation. Several case studies, however, went even one step further: the establishment of a compatible and complete backup computer. In Indianapolis (police computer) and Tampa (CAI), for instance, the agency's computer and the county computer were designed to be compatible; each could serve as a reserve unit for the other. Boston (police computer) had a similar arrangement with the city computer, and in Nashville (police computer), there were actually two core computers, one for on-line and the other for batch applications—but each core computer was capable of performing the other's functions.

For other types of innovation, including most of the remaining ones that were part of this study, internal capabilities were sufficient for servicing the innovation. For instance, in Dallas (MICU), in which the MICU vehicles were repaired and maintained by the fire department's regular maintenance shop, specific increases in the maintenance staff were made by the agency to accommodate the new functions. Similar arrangements were established in Birmingham. However, not all case studies were able to establish regular procedures for using such internal capabilities. In CCTV systems, for instance, much of the repair and maintenance fell on the staff of the audio-visual department or special television production staff that had been hired in conjunction with the innovation. Staff turnover and inherent equipment defects led to the neglect of maintenance and repair in Rochester and Omaha.

For the three breath testing case studies, maintenance and supplies were generally provided directly through the operating unit concerned with the innovation (e.g., an officer in the traffic department), and not through the agency's maintenance shop. In these cases, however, the agency had to be aware of the tradeoffs between having one officer conduct all service and repair (which ensures more consistent treatment of the equipment), and having a larger number of operators trained to perform such services (which ensures that the services would survive personnel turnover). In all three case studies, the agencies had actually done both; a single officer tended to have the main responsibility, but the training for new breath testing operators included specific instruction regarding maintenance and repair, and these operators were therefore in a position to replace the active incumbent if he left the agency or took a new position. As for the Jet-Axe case

studies, satisfactory arrangements only required that the fire departments establish adequate purchasing procedures because individual Jet-Axes were entirely consumed by use and hence involved no maintenance or repair.

In summary, the Expansion Stage was the appropriate time for developing self-sufficient procedures for maintenance and supply. Although a key objective was still to make whatever repairs were needed to keep the innovation operating, a complementary organizational goal was now relevant: The procedures for maintenance and supply became a part of standard agency operations and were not merely based on ad hoc arrangements. Where such ad hoc arrangements were eliminated and replaced, the innovation successfully achieved another passage (see Table 9).

Internal Personnel Classifications or Certification Procedures

A fifth way in which innovations became integrated into local service agencies was through the development of new personnel examinations and classifications to cover the special skills related to the staffing requirements of the innovation. This change occurred either through civil service classifications or through formal training and certification procedures (see Table 9). In either case, the middle period in the life history was an appropriate time to initiate such procedures on a permanent basis. This was because it could take two or three years to establish new personnel classifications, so that an early start was helpful. At the same time, the initiatives were difficult to make during the Improvisation Stage because of the instability of different roles and the lack of time and experience needed to assemble the necessary documentation.

Civil Service Changes. In some cases, skills were new to an agency but might have existed in the employment market at large; in other cases, the skills reflected technological advances that had resulted in the creation of new personnel specialties. In a computer innovation, for instance, the staff included keypunch operators, programmers, and other technicians related to the operation of the computer system. For many cities, job classifications for these skills already existed in the county-wide (e.g., Tampa, CAI; and Indianapolis, police computer) or even statewide (e.g., Boston, police computer) civil service system. Integration into a specific department was thus a matter of using these existing classifications. For other cities (e.g., Miami and Nashville, police computer; and Dallas and San Diego, CAI), new classifications were developed within the appropriate agency's civil service system. Advances in the state of the technology with computer systems, however, also required an ability to update classifications—e.g., from keypunch operators to data entry clerks. This updating occurred at the city level if such skills were needed by several city agencies, or it occurred in relation to a specific department such as the police.

The development of appropriate personnel classifications was necessary to the long-term survival of the innovation for two reasons. First, such classifications allowed an agency to make the skills related to an innovation part of the regular staff of the agency, facilitating the allocation of permanent positions for these staff. Secondly, these classifications provided the agency with an ability to compete in the employment market for persons with the relevant skills. In the CCTV cases, for instance, the establishment of the appropriate classifications allowed the CCTV systems to pay higher salaries to the necesssary specialists. Conversely, in a computer system, if a systems analyst function could, for instance, only be filled by

persons who were classified as programmers, it was less likely that the agency would be able to recruit the appropriately skilled person at a sufficiently high salary.

External Training and Certification. Some innovations called for an expansion in existing staff skills rather than new civil service classifications. This occurred, for instance, with MICU or breath testing, where the innovation could be staffed by existing police or fire officers but where such officers required special training or certification beyond their initial civil service qualifications. In these cases, the certification procedure (usually established by the state) played a comparable role to that of developing a new civil service classification. It was thus important to formalize the certification procedure, and in most of the case studies on these two innovations, not only had such formalization occurred but there was also a new procedure developed for refresher training and recertification. A paramedic for the Dallas MICU operation, for instance, received initial training from the medical school, was certified for a two-year period by the state department of public health (upon passing an examination), was given a two-week refresher course, and was then recertified for another two years (upon passing an examination again). In Birmingham, a paramedic not only had to follow these training and certification procedures but the paramedic position had also been established as a civil service classification.

The need to rely on training and certification procedures, however, made the innovation somewhat more vulnerable than if civil service classifications were established. This was because training and certification were often provided by external agencies (such as a public health department or a medical school), and there was no ready assurance that the external agency would continue its participation. For this reason, the *internalization* of certification procedures was considered a part of the definition of a satisfactory passage. This only occurred in one MICU case (Birmingham) and in one breath testing case (Cincinnati). At the latter site, certification had become part of the regular program of the police academy; officers who served as teachers in the academy received their certification (as teachers) from the state public health department. In another breath testing case (Akron), training was done internally but not as part of the police academy curriculum. The officer who did the training had also been certified through public health agencies but had just retired at the time of the case study, and his replacement had not yet been certified to conduct the appropriate training. Thus, the nature of the training program's continuation was uncertain. Similarly, in the third breath testing case (Memphis), the certification program was operated by a local university and had not been internalized. In one MICU case (Denver), the cessation of the innovation occurred with the withdrawal of the general hospital that had provided training and certification. The fire department actually had little choice, because there was no state training or certification program to use as an alternative.

Classification for the Coordinator. One position that usually required a new classification, whether through the civil service system or through formal training and certification from an external source, was the coordinator or supervisor of the innovation. This person had the day-to-day responsibility for the innovation, and no matter how the innovation was organized, this coordinator position or its functions was generally new to the agency. Although an incumbent could begin serving in this capacity during the Improvisation Stage without an official personnel clas-

sification, such action had to occur in the long run. The coordinator role was sometimes defined as an entirely new position (e.g., Dallas and San Diego, CAI), or it was integrated as a formal responsibility of an existing official (e.g., Cincinnati, breath testing). Because of the importance of formalizing the coordinator's position, a critical test of the first coordinator for an innovation, in fact, was whether he or she could establish the appropriate training, certification, or new classification procedures so that the next incumbent could be hired.

Summary

The Expansion Stage provided the first real tests for the routinization of an innovation. For innovations that were becoming routinized, the achievement of five passages or cycles generally occurred during this stage: equipment turnover and updating, transition from external to internal funding, changes in organizational identity, internalization of maintenance and supply capabilities, and initiation of personnel classifications and certification procedures. Although a particular innovation might not have accomplished all these passages or cycles during the Expansion Stage (and some of the innovations might have accomplished the passages and cycles earlier), subsequent routinization was more likely to be achieved if more of these events had taken place. Conversely, an innovation that had expanded without accomplishing any of these organizational tasks was not likely to achieve status as a part of an agency's "standard practice."

Table 9

Summary of Passages or Cycles During the Expansion Stage

Type of Innovation/Site	Passage or Cycle 1: Achieved Equipment Turnover or Sequential Purchases		Passage or Cycle 2: Achieved Transition to Support by Local Funds		Passage or Cycle 3: Achieved Appropriate Organizational Status		Passage or Cycle 4: Achieved Stable Arrangement for Maintenance & Supply		Passage or Cycle 5: Internalized Personnel Classification or Certification	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Police Computer										
Miami	✓		✓		✓			✓	✓	
Indianapolis	✓		✓		✓		✓		✓	
Nashville	✓		✓		✓		✓		✓	
Boston	✓		✓		✓		✓		✓	
Breath Testing										
Cincinnati	✓		✓		✓		✓		✓	
Akron	✓		✓		✓		✓			✓
Memphis	✓		✓			✓	✓			✓
MICU										
Dallas	✓		✓		✓		✓			✓
Birmingham	✓		✓		✓		✓		✓	
Denver		✓		✓		✓		✓		✓
Jet-Axe										
Rochester	✓		✓		✓		✓			✓
Omaha	✓		✓		✓		✓			✓
CAI										
Dallas	✓		✓		✓		✓		✓	
Oakland		✓	✓			✓	✓			✓
Tampa		✓	✓		✓		✓		✓	
San Diego	✓		✓		✓		✓		✓	
CCTV										
Omaha		✓	✓			✓		✓	✓	
Portland		✓	✓		✓		✓		✓	
Rochester		✓	✓			✓		✓	✓	

Table 10

Summary of Passages or Cycles During the Disappearance Stage

Type of Innovation/Site	Passage or Cycle 6: Changes in Organizational Governance		Passage or Cycle 7: Internal Training Program		Passage or Cycle 8: Promotion of Personnel Acquainted with Innovation		Passage or Cycle 9: Eventual (Late) Turnover in Key Personnel		Passage or Cycle 10: Attainment of Widespread Use	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Police Computer										
Miami	✓			✓	✓		✓			✓
Indianapolis	✓		✓		✓		✓		✓	
Nashville		✓	✓			✓	✓		✓	
Boston		✓		✓	✓		✓			✓
Breath Testing										
Cincinnati		✓	✓			✓		✓	✓	
Akron		✓		✓		✓	✓		✓	
Memphis		✓		✓		✓		✓	✓	
MICU										
Dallas	✓			✓		✓		✓	✓	
Birmingham	✓			✓	✓		✓		✓	
Denver		✓		✓		✓		✓		✓
Jet-Axe										
Rochester		✓	✓			✓		✓	✓	
Omaha		✓	✓			✓		✓		✓
CAI										
Dallas	✓			✓	✓		✓		✓	
Oakland		✓		✓		✓		✓		✓
Tampa	✓			✓		✓		✓		✓
San Diego	✓		✓		✓			✓	✓	
CCTV										
Omaha		✓		✓		✓		✓		✓
Portland		✓		✓		✓		✓		✓
Rochester		✓		✓		✓		✓		✓

Chapter VI

LIFE HISTORIES, STAGE 3: THE DISAPPEARANCE STAGE

The main theme of the final period in the innovation life histories was the cessation of the innovations' identity as an innovation. This meant that the functions involving the innovation continued, but they were no longer regarded as peculiar, special, or ad hoc. Where routinization was achieved, the functions were established as a standard part of agency practice. Thus, "disappearance" connoted a final shift in the innovation's *perceived* status; it did not mean that the innovative functions had been terminated by the agency.

It is obviously very difficult to define this final shift. In general, if one were tracking the life history of an innovation from its inception, there might always be a tendency to find some remnant of the innovation that could continue to be labeled as a new function. An insight into the process is provided, however, if one examines an agency's current practices and retrospectively attempts to identify those functions that were once innovations. Such a retrospective view makes the shift more apparent. An example may be helpful. In most urban police departments, the use of walkie-talkies by patrol officers would now be perceived as a regular part of police practice. The walkie-talkies are a standard part of the patrol officer's equipment, the procedures for using the walkie-talkie are taught as part of every patrol officer's basic training, and the communications functions served by the walkie-talkies are an integral part of everyday procedures. If police departments were now precluded from having walkie-talkies, the entire department, including both the top administrators and the patrol officers, would probably object to the removal of part of its "normal" service capabilities. This entire array of conditions constitutes a routinized practice. Yet, walkie-talkies were clearly once an innovation (most police departments only began using such equipment about 20 years ago); moreover, a new type of walkie-talkie (e.g., a minicomputer that allows both voice and digital communication) would now be considered a "new" innovation.

Similar examples may be found in other local service agencies. Specific practices for using such items as audio-visual equipment in schools, call boxes and patrol cars in police departments, or any number of fire extinguishing instruments in fire departments were all once innovations. They all now appear as part of standard practice, often accepted not only by agency officials but also by the public as a standard part of the definition of a contemporary service agency. In other words, the retrospective view provides clear evidence that numerous innovations have now become incorporated into the functions of an agency such as a police department. Taking a very long-term perspective, a standard textbook on police operations has summarized many law enforcement changes in a way that best illustrates the retrospective view (Wilson and McLaren, 1972):

> Police methods have changed greatly during the past hundred years. The police today use almost every conceivable means of transportation and communication. The horse patrol and nightstick gave way to automobiles containing teleprinters, helicopters with television, and jet flying belts. Modern communication centers tape-record telephone messages and com-

> plaints as well as radio dispatches .... Police dispatchers now have access to computer-based visual-display terminals giving identification data, records of wanted property, and other information of great tactical value. Telephonic devices can automatically record onto dictating machines reports made by officers from any telephone, and these reports can be transcribed onto a master from which any desired number of copies of the report may be reproduced. These systems are gradually replacing the typing of reports by the officers themselves as well as eliminating the frequently illegible copies of reports that resulted from the use of carbon paper. Television-based filing and retrieval systems now permit nearly instantaneous capture, storage, and random-access retrieval of documents with resolution high enough to permit classification of fingerprints transmitted by the system.

Examples of this final shift, or "disappearance" of an innovation, are thus readily apparent retrospectively. The problem posed when tracking specific life histories, however, is to identify the operational changes that are associated with the shift. Once again, the notion of specific *passages* and *cycles* was relevant; the more passages that had been achieved by an innovation in this final stage of its life history and the more cycles that had passed, the more that disappearance appeared to have occurred. Based on the case studies, at least five types of passages and cycles were relevant:

- Changes in organizational governance—i.e., the rules affecting the basic definition of the service agency's functions and responsibilities (passages).
- Internalization of all training procedures so that new practitioners continually learn how to use the innovation (passages).
- Promotion of personnel who are acquainted with and support the innovation (cycles.)
- Eventual turnover in the key personnel directly coordinating the innovation (cycles.)
- Expansion of the use of the innovation to the full range of possible service users (cycles.)

The remainder of this chapter elaborates on each of these passages and cycles and the experiences found in the case studies. As in the previous chapter, a summary status table (Table 10) is presented at the end of this chapter.

Changes in Organizational Governance

The role of any agency is defined by certain rules of governance—e.g., the language in state legislation or city ordinances, an agency's own standard operating procedures, a provision in a collective bargaining agreement, or a public mandate such as a bond issue. Although such rules can be changed and reversed, the time needed to make such changes is often a period of years. In the case studies, innovations were integrated into agency practice by becoming part of such rules. This change could require much time and effort, but once an innovation was integrated in this manner, further reversal could take even more time and effort, and hence routinization was much more likely to occur. The lengthy period needed to make such a passage meant that changes in organizational governance could occur late in an innovation's life. However, it sometimes occurred as part of the Improvisation Stage because such changes were part of the initial adoption of the innovation.

In most of the case studies, the use of the innovation resulted in changes in standard operating procedures. Revisions in the procedural manual of the agency, for instance, were part of the implementation of the breath testing innovations in Cincinnati and Akron. Such changes, however, can often be ignored or revised without great difficulty, and thus other governance changes were more potent and only these were counted as sufficient for a passage to have been achieved (see Table 10). A city ordinance, for instance, defined the role of the police computer system in Indianapolis and the MICU systems in Dallas and Birmingham and provided the basis for budget requests for these innovations; a bond issue explicitly included support of the police computer system in Miami, and Miami also instituted an arrangement whereby its regular crime reports to the state were physically conveyed in the delivery of a computer tape, and not merely reports or printouts; and CAI terminals in Dallas were purchased as part of the school district's compliance with court-ordered desegregation, establishing CAI as an integral part of the school system—i.e., the terminals could not be used for non-CAI purposes nor could CAI be allowed to fall into general disuse without raising issues of noncompliance with the desegregation order.

Other variations existed as well. In San Diego, CAI terminals were made part of the standard equipment for new school buildings, so that the terminals could be purchased with funds from a bond issue. A similar change occurred in Tampa, where CAI terminals (and hence minicomputers) were purchased with capital funds in conjunction with the construction of a new wing to an existing school building. In school districts, other changes in governance involved the certification of specific courses in the curriculum (e.g., Dallas's advanced computer mathematics course received state certification), and ultimately, the adoption of new textbooks that were in part based on the innovation (e.g., CAI-based textbooks were being considered by the San Diego district).

For most MICU and breath testing innovations, state certification procedures and standards reinforced the use of the innovation. New state laws, for instance, set certain standards for using breath testing equipment, mainly by establishing the BAC level for defining an intoxicated condition. Perhaps the most dramatic change, however, occurred in Birmingham, where the success of the MICU system caused the fire department to change its name to "fire and rescue squad," in explicit recognition of the new functions being performed as a result of the innovation; subsequent review of the agency's budget automatically assumed the additional workload imposed by the MICU service, and not merely that associated with firefighting.

Unlike some previously described passages and cycles (e.g., equipment turnover, external to internal budget support, formal organizational identity, and stable supply and maintenance procedures), which tended to be necessary but not sufficient conditions for routinization, these changes in organizational governance appeared to serve as an important component of routinization. Unfortunately, a particular innovation did not always have an opportunity to be part of a revision in a rule for organizational governance. Most innovations, in fact, may not have such opportunities and will have to rely on the aggregate effect of other factors to attain routinization. Nevertheless, innovators concerned with establishing an innovation on a long-term basis constantly sought opportunities to change the rules of governance as an effective means of achieving routinization.

Internalized Practitioner Training

The Improvisation Stage stressed the need for some initial practitioner training to use the innovation. An important objective then was merely to expose as many practitioners as possible to the innovation and to be certain that sufficient staff personnel could properly use the innovation. As a result, an important step during the Improvisation Stage was the establishment of some training sessions, either conducted by the agency itself or even conducted with the assistance of an outside vendor.

In contrast to the training needs of the Improvisation Stage, there was a need during the later stages in the innovation life histories to develop a regular, ongoing training program. No matter how many times a training program had been repeated, there were certain transitions needed before routinization could occur. For fire and police departments, the bulk of the practitioner's initial training took place in the fire or police academy. Therefore, training requirements associated with an innovation had to become part of the academy's curriculum in order to routinize the training. In addition, fire departments offered regular training sessions in the firehouse, usually to keep certain firefighting skills in practice and up-to-date. Training requirements in relation to an innovation were therefore also integrated with these other activities in the firehouse. For school districts, the initial practitioner training occurred during the practitioner's formal college or graduate education. Because such university programs were not directly linked to specific school districts, as was the academy to a police or fire department, it was difficult to expect university curricula to change quickly in relation to the training requirements for an innovation (although such change in the curriculum would probably constitute a potent transition for routinizing an innovation). A more frequent outcome was that in-service training programs, allowing a teacher to update and broaden his or her skills once on the job, gradually reflected the training related to an innovation. Such integration was an important passage. Whether training involved the academy or in-service programs, the incorporation of specific curricula tended not to occur until late in an innovation's life history; time was needed to identify the training resources, to organize the specific training lessons, and to gain approval for such activities. Furthermore, the process could be prolonged because the governing board and the teaching staff often drew their memberships from the older practitioners in an agency, and such persons were not always likely to adopt positive attitudes toward new practices. For these reasons, the transition from ad hoc to regular training programs typically occurred during the Disappearance Stage.

The two Jet-Axe case studies both accomplished the transition into the fire academy and the firehouse curricula. In Rochester, the training in the academy had actually been delayed because there were no classes for new trainees for two years due to budgetary constraints. As soon as enough new students were admitted to constitute a class, however, the academy program was enhanced to include a few hours of training concerning the use of the Jet-Axe. To the extent that movies, lectures, and manuals sufficed, all new firefighters were taught about the Jet-Axe and its operation; of course, as previously mentioned, little actual practice was possible because of the few Jet-Axes that could be detonated in training demonstrations.

Similarly, other types of innovations also resulted in changes in the training program in the police or fire academies, but in a less organized manner. For police

computers, Indianapolis and Nashville (but not Miami or Boston) established orientation programs for data processing, so that all new officers in the academy would be able to use available terminals or otherwise take advantage of the computer resources of the department. For breath testing, Cincinnati and Akron were both able to install orientation programs for all new officers in the academy (i.e., so that all new officers would be aware of the procedures even if they were not to become actual breath testing operators); Cincinnati also provided the formal training for breath testing operators as part of the academy's curriculum. Training for breath testing operators in both Akron and Memphis, however, continued to be provided by external groups—a state health department in one case and a university in the other. Such external training, which was also used in the MICU cases, can often be adequate in the long run. However, there is always the possibility that the external source, especially if not a city agency, will be unable to provide the training (or may change the ground rules for providing the training) at some future date, and thus the passage to internal training programs was still considered to be essential for routinization and was not considered as having been achieved in these cases.

With the educational innovations, in only one case (San Diego) was there any evidence of formal changes in in-service programs. In all other cases, although some in-service sessions were held, and in some cases were even conducted regularly, the formal program appeared not to have been affected. In contrast, the San Diego system provided CAI training as a formal part of the in-service program, with specific credits given that could also result in increased salaries. The training program, incidentally, also included some lessons on the maintenance and repair of the CAI terminals.

Without successful passage into internal training programs, it is difficult to conceive of an innovation becoming a part of "standard practice." The very notion of such a body of standard practice implies that practitioners learn to do things a particular way in their initial training that enables them to become practitioners. If an innovation demands some special skills, and if learning these skills is not part of the regular curriculum, the skills may always be considered somewhat external to standard practice. Hence the use of the innovation may also be perceived as falling outside the core activities of an agency. In summary, some significant portion of the training ultimately had to become part of the practitioner's initial education, either in a fire or police academy or in a school of education, for the use of an innovation to become fully routinized (see Table 10).

Promotion of Personnel

A major cyclic activity in organizations is the promotion of personnel from one rank to another. Most employees may have three or four promotions during their careers. For local service agencies, these promotions were the main sources of new recruits for all but the entry-level positions. This is due to the existence of personnel policies that disfavor lateral entry and that instead rely heavily on promotion from within the ranks. The consequent closed nature of local service agencies is a characteristic shared by police departments, fire departments, and school districts alike; persons outside the agency are only likely to be recruited at the very beginning of their service careers (e.g., qualifying by taking a civil service entrance examina-

tion), or at the top of the agency, where new appointees are usually selected by the mayor or city council and hence frequently involved candidates from outside the agency.

Due to the general pattern of vertical mobility, promotions of persons directly familiar with the innovation were quite likely to occur during the later stages of an innovation's life history. Such promotions were important to the innovation's routinization for two reasons. First, if an official that had been using the innovation and had been pleased with it was promoted, such an official was likely to support the innovation from the vantage point of his or her new position. Often, this new position involved greater managerial power, and support for the innovation consequently became more solidified. Thus, in three of the four police computer case studies (all but Nashville), a new police chief was appointed after the innovation had been operating for several years. In each of these three cases, the new police chief had previously been an officer within the department, and had directly helped to plan or implement the police computer system. In one case (Indianapolis), the new chief had actually been the coordinator of the computer system in his prior position. In these three cases, the promotions meant that the top executive in the agency was more supportive of the innovation, more likely to make personal use of it (e.g., reviewing computer printouts), and more sophisticated in seeking new service applications for it; of course, a concomitant development was that the agency head could also be more careful and critical in budget and other reviews of the innovation's services. However, on balance, promotion meant increased support for and acceptance of the innovation.

Similar promotions to executive level positions, involving persons who had direct contact with an innovation, were potentially possible with the other types of innovation but only occurred in one case study besides the police computer cases. This was a CAI innovation (Dallas), where the incumbent originally involved with the data processing system then became the comptroller of the school district. From this new vantage point, the comptroller made more supportive decisions concerning the use of the school computer, both for administrative and for CAI applications.

The second way in which promotions were important to an innovation's routinization involved the practitioner rather than the top executive; practitioner promotions or transfers (from one subdistrict to another) could incorporate the skills in using the innovation as criteria for promotion or transfer. In only two case studies did this occur to any degree. In Birmingham (MICU), the paramedic position was integrated into the general promotion ladder from one officer rank to another. In other words, service as a paramedic gave an incumbent additional credentials for being promoted into the next higher rank. In San Diego (CAI), teachers were transferred to new schools in part on the basis of their CAI experience. Although such transfers did not require a CAI background, at least the function was perceived as part of the desirable credentials for the transfers. In a third case study (Dallas, MICU), a modified promotion ladder, integrating the paramedic position with regular fire officer ranks, was under consideration but no action had taken place by the end of the case study.

The occurrence of both types of promotional changes—of individuals to top-level positions and of practitioner-level promotions or transfers—clearly put an innovation in an advantageous situation. Moreover, these promotions were cyclic

events, so that the longer an innovation was in use, the more likely that individuals acquainted with the innovation were to be promoted. After a long period of time, the systematic promotion procedures can, of course, result in the replacement of nearly the entire staff of an agency. This will not only produce broader support and familiarity with the innovation, but in the long run it may lead to the elimination of any knowledge of agency practices before the innovation was initiated. Because this is clearly a long-term development, survival over promotion cycles was regarded as a characteristic of the Disappearance Stage of an innovation (see Table 10).

Eventual Turnover of Key Personnel

At some point in an innovation's life history, the key personnel who initially supported or implemented the innovation may leave their positions. Such turnover in the agency head's position or the coordinator's position represented a critical event in an innovation's life history. If turnover occurred too early, before an innovation had been operating properly, the innovation's survival in the agency was severely threatened, and the innovation could fail to achieve later passages or cycles. If turnover failed to occur at all, however, this was also detrimental because the innovation could have become permanently associated with a specific group of persons rather than with the agency as a whole. This latter situation strikes at the heart of the "institutionalization" problem, for institutionalization or routinization ultimately means that an innovation can survive in an organization without the continued support of the same individual or group of incumbents. Too often in recent years, for instance, an innovative mayor or police chief has taken office and initiated many new practices. When the term of office of this person has expired, the incumbent has taken a position in another city, and the innovations in the original city have ceased. The innovations, in short, were only associated with a particular incumbent and not with the general role of the mayor's or police chief's office.

Turnover in the role of the innovation's key personnel therefore represented another important organizational cycle; two, three, or more incumbents could sequentially replace each other in a given position. For routinization, the turnover issue is a complex one. There must be very little turnover at the outset—i.e., during the Improvisation Stage—but it was desirable to have some turnover in the later periods—i.e., during the Disappearance Stage. The later turnover was often associated with other important organizational changes. For instance, if there had been no turnover, it was less likely that all key procedures had been fully documented. Only when a new coordinator took over was an agency put to the real test of showing that it could keep the innovation operating without the assistance of the initial coordinator. What was therefore important in assessing turnover was not merely to record the number of turnovers, but also to note when such turnover occurred in relation to an innovation's life history (see Table 10).

Turnover in the data processing coordinator's position was found in all police computer case studies. Moreover, the turnover was not disruptive; the core computer continued to increase in size or to add applications, and the computer system continued to achieve other important organizational passages. The new data processing coordinators were all persons who had previously served in more junior capacities (e.g., assistant coordinator) in relation to the innovation. In one case (Nashville), the new coordinator had been a member of the vending company that

had provided the computer equipment to the police department. Naturally, the turnover in all cases was marked by some transition problems and adjustments in personal relationships. However, the main accomplishment was that the innovation was no longer identified with the original incumbent alone. Moreover, the new coordinator often brought new ideas for expanding the use of the innovation. In short, the turnover showed that the innovation was now a part of the agency's practice independent of any single incumbent, and furthermore that a line of succession had been established for providing future coordinators.

Turnover did not occur as uniformly in the other innovations in the case studies. A new coordinator was appointed in the later phases of the Akron breath testing innovation, but no such turnover occurred in either of the other breath testing cases. In Cincinnati, however, the success of the innovation had gradually allowed the traffic commander who was doubling as coordinator to spend less time on the innovation. Similarly, new coordinators were appointed in the later period of two other innovations (Birmingham, MICU; and Dallas, CAI), but not in any of the other cases. In a few of those other cases (Oakland, CAI; and Omaha, Portland, and Rochester, CCTV), turnover among key personnel occurred early in the life history and appeared to have negatively affected the operation of the innovation.

Expansion to Full Range of Potential Users

A final characteristic of the Disappearance Stage was for an innovation to be adopted by the full range of potential users. This characteristic again strikes at the heart of routinization: If an innovation is only being used by some special subset of practitioners even though its functions are theoretically applicable to all practitioners, the innovation will continue to be regarded as special and not part of standard practice. "Standard practice," in short, implies practice by all.

Unfortunately, without a detailed analysis of specific organizational practices that would demand far more fieldwork than was possible, it was extremely difficult to determine whether an innovation had reached its full set of potential users. The propositions reflecting full use, if it could be measured, might be as follows:

- For police computers, the computer system is used for a large number of applications; for each application, such as traffic citations, all practitioners involved in processing new entries or reports use the computer system and do not rely on any manual system that duplicates what the computer can do.
- For breath testing, all tests for DWI are conducted with breath testing equipment, with urinalysis or other older practices used as a supplement but only for specially defined situations.
- For MICU, an MICU unit responds to all calls for fire and non-fire emergencies.
- For Jet-Axe, the equipment is used wherever barriers of a certain type (which, however, are extremely difficult to define) are encountered in firefighting.
- For CAI, all teachers for a given subject (e.g., mathematics) integrate CAI into their classroom activities if CAI programs have been developed for that subject; more desirably, CAI programs are developed for numerous subjects, and all teachers for these subjects use CAI.
- For CCTV, the conditions are the same as those just mentioned for CAI.

In lieu of assessing the extent to which any site had achieved these conditions, certain proxy or substitute indicators had to be developed. The general notion was to assess the size of the innovation at the time of the case study in relation to the size of the innovating agency or its clients. If an innovation involved an on-line police computer system, for instance, it was assumed that, regardless of the types of computer applications, some minimal number of on-line terminals would have to be present for the innovation to be regarded as having achieved full or near-full use.

The field observations for each case study led to specific impressions concerning the level of use of an innovation. Although these impressions were initially subjective ones, the case studies were then categorized according to whether widespread use or partial (or no) use had been observed. These observations are summarized in Table 10, and represent the final judgments regarding the attainment of widespread use for the innovation in each case study. These subjective judgments were then made operational by observing that, if certain features of each innovation were selected, the following cut-off points appeared to characterize the fully utilized cases:

- For police computers, the ratio of on-line terminals to police employees was 1 terminal for about every 40 employees in the police department.
- For breath testing, the number of trained breath testing operators was about 1 trained operator for every 100 employees in the police department.
- For MICUs, there was about 1 MICU vehicle for every 100 employees in the fire department.
- For Jet-Axes, there was an average of about three Jet-Axes used per year by the fire department for the duration of the life of the innovation.
- For CAI, the ratio of computer terminals for CAI use was 1 terminal for about every 2,500 students in the school district.
- For CCTV, the ratio of television receivers connected to the CCTV system was about 1 receiver for every 300 students in the school district.

Among the police computer case studies, two sites (Indianapolis and Nashville) had achieved full use, but two (Miami and Boston) had not. In Miami, on-line applications were just being implemented at the time of the case study in conjunction with the acquisition of a new computer system; in Boston, the computer system had been fully utilized at one point in its life history, but the Boston city government had taken over the major computational responsibilities several years ago, leaving the police department with two functions: a computational ability to perform message switching and therefore to act as a user of the city's system, and an emerging computerized-dispatching application that was being implemented at the time of the case study.

Similar contrasts were found for four of the five remaining types of innovations. The Denver MICU case never involved more than two vehicles under the control of the fire department; only six Jet-Axes had ever been detonated in total by the Omaha fire department over a five-year period; the Oakland and Tampa CAI systems had not expanded to more than about a dozen classrooms throughout the whole school district (Oakland had 13 CAI terminals and Tampa had 10); and none of the three CCTV systems were currently being used as CCTV systems, although

full utilization had been achieved at one time in Rochester and the Portland system was being fully used, but as an ITV and not a CCTV system. For the last innovation, breath testing, all three sites were operating at a full level. In all, 10 of the 19 sites had attained widespread use at the time the case study observations were made (see Table 10).

Summary

The Disappearance Stage was the final period in an innovation's life history. During this period, the remaining passages and cycles occurred that ultimately led to the full incorporation of an innovation. Innovative practice had become standard practice.

Five passages or cycles have been discussed: changes in organizational governance, internalization of training programs, promotion of personnel acquainted with the innovation, turnover of key personnel, and attainment of widespread use of the innovation. Most of the passages involved multi-year time lags between the initiation and completion of the passage; similarly, most of the cycles occurred less frequently than on an annual basis. Thus, it was considered appropriate that these passages and cycles were characteristic of the Disappearance Stage. If one compares Table 9 (from the previous chapter) with Table 10, noting the degree to which the passages and cycles had been achieved by the 19 case studies, the proportion successfully attaining any given passage or cycle for the Expansion Stage was generally higher than the proportion for the passages and cycles in the Disappearance Stage. To this extent, the observations from the case studies illustrate the distinction between the two stages.

A fully routinized innovation was therefore characterized by the attainment of all ten passages and cycles—five in the middle period and five in this last period. If all ten had been attained, the innovation was no longer likely to be considered an innovation, and its functions had been established as standard practice. In other words, an outsider analyzing the agency's operations would now regard such functions as an integral part of the agency's work.[1]

[1] This assertion can, of course, be easily tested by assessing the perceptions of new practitioners entering an agency (or of other persons acquainted with the agency); however, such testing was beyond the scope of the present inquiry. In general, it would be predicted that practitioner and administrator perceptions would acknowledge the practice as standard.

Chapter VII

EXPLAINING ROUTINIZATION

A. ASSESSING THE DEGREE OF ROUTINIZATION

What does it mean for a new service practice to become routinized? The preceding chapters have described 19 life histories that have emphasized the occurrence of specific *passages* and *cycles*. These organizational events have been used to assess the degree of routinization, with the process appearing to progress through three stages—an Improvisation Stage, an Expansion Stage, and a Disappearance Stage. Table 11 shows these three stages and the total passages and cycles achieved in the 19 life histories.

The more passages or cycles that a given innovation has achieved or survived, the more routinized the innovation has become. In other words, if one examines specific agency practices and distinguishes subjectively according to the degree to which each practice appears to be part of an agency's everyday—i.e., routine—business, the subjective impression appears to be confirmed by accounting for the number of passages or cycles achieved in relation to each practice. Under the specific conditions governing any given agency and innovation, some passages and cycles may be more important than others. However, for the aggregate analytic purposes of the present study, each of the ten passages or cycles has been assumed to carry an equal weight in defining the degree of routinization of an innovation.

Table 11

Summary of Passages and Cycles in an Innovation's Life History

Passage or Cycle Number	Life History Stage	Number of Case Studies Achieving Each Passage or Cycle
	Improvisation Stage	
	(no necessary passages or cycles)	
	Expansion Stage	
1	Equipment turnover	13
2	Transition to support by local funds	18
3	Establishment of appropriate organizational status	14
4	Establishment of stable arrangement for supply and maintenance	15
5	Establishment of personnel classifications or certification	12
	Disappearance Stage	
6	Changes in organizational governance	7
7	Internalization of training program	6
8	Promotion of personnel acquainted with the innovation	6
9	Turnover in key personnel	7
10	Attainment of widespread use	10

This framework for assessing routinization is essentially a structural one, reflecting the organizational status of a particular innovation or practice. The passages and cycles are specific organizational activities that are observable and that define the organizational status of a practice. Such activities have been largely ignored in previous research, and thus the main focus of the present study has been to define—perhaps for the first time—such explicit and discrete organizational events. At the same time, no attempt has been made to develop corroboratory perceptual or attitudinal evidence. Yet, in the final analysis, a routinized practice is one that has achieved a certain organizational status as well as one that is perceived as "standard" or "normal." The accumulation of relevant perceptual evidence may be seen as a task for further research.

Routinization Scores and Ratings

Given this structural approach, the degree of routinization of the 19 innovations was summarized in terms of a routinization score and rating, based on the number of passages and cycles achieved by each innovation. This score was simply a summary tabulation of the passages or cycles achieved by each innovation, as presented in Tables 9 and 10 of the previous two chapters. The final tabulation is shown in Table 12. The ratings were created by assigning the innovations to three groups, based simply on a one-third division among the scores: 7 to 10 passages or

Table 12

Ratings and Routinization Scores for 19 Innovations
(Case Studies)

Case Study	Type of Innovation	Rating/Routinization Score
		Highly routinized
Indianapolis	Police computer	10
Birmingham	MICU	9
Dallas	CAI	9
San Diego	CAI	9
Nashville	Police computer	8
Miami	Police computer	7
Boston	Police computer	7
Cincinnati	Breath testing	7
		Moderately routinized
Akron	Breath testing	6
Dallas	MICU	6
Rochester	Jet-Axe	6
Omaha	Jet-Axe	6
Tampa	CAI	5
Memphis	Breath testing	4
Portland	CCTV	4
		Marginally routinized
Oakland	CAI	2
Omaha	CCTV	2
Rochester	CCTV	2
Denver	MICU	0

cycles (highly routinized); 4 to 6 passages or cycles (moderately routinized); and 0 to 3 passages or cycles (marginally routinized).

The summary scores indicated that, of the 19 innovations, many (all four police computer systems; Birmingham, MICU; Cincinnati, breath testing; and Dallas and San Diego, CAI) had already achieved a rating of highly routinized. At the same time, several other innovations (Denver, MICU; Oakland, CAI; and two of the three CCTV innovations) had only begun to be routinized and were rated as marginally routinized. The remaining innovations all fell in the middle range and were rated as moderately routinized. This distribution of the scores, it should be remembered, was in part a result of the procedure used for selecting the 19 case studies. (The selection process had deliberately screened for a stratified sample according to the age and use of various innovations; see Chapter I.)

A similar procedure was applied to the 90 innovations covered by the telephone interviews. The telephone questionnaire included the same ten passages or cycles, but the responses to three could not be used because of ambiguous or inaccurate wording in several questions.[1] For instance, although a detailed question was included concerning turnover in key personnel (passage or cycle No. 9), the specific dates of such turnover were not identified, and it was impossible to say when the turnover had occurred in the life history of the innovation. For this particular cycle, the time of occurrence is extremely important to routinization—e.g., turnover that occurs too early in the life history may have negative effects. For the seven remaining passages or cycles, however, the 90 innovations were similarly ranked according to the total number of passages or cycles that had been achieved.

There were variations in the application of the passages and cycles to each type of innovation, due to the fact that different questionnaires had to be used for each innovation. For MICU and CCTV, all seven remaining passages or cycles were used in constructing the routinization score. For police computers and CAI, the maintenance and supply measure (No. 4) was not precise enough to distinguish initial versus longer-standing arrangements; thus, these two innovations had routinization scores based on six passages and cycles. The equipment turnover—i.e., dates of new purchases (No. 1)—and maintenance and supply (No. 4) questions were not included in the Jet-Axe interviews, and the personnel classification (No. 5) and operating funds (No. 2) questions were inadvertently omitted from the breath testing interviews. As a result, the routinization scores for these two innovations were based on five passages and cycles. Despite these differences, however, the scores for the six innovations were all weighted to a 7-point scale for purposes of comparison. These scores, ranging from 0 to 7, were then used as the basis for dividing the innovations into the three rating categories—highly routinized (5, 6, or 7), moderately routinized (3 or 4), and marginally routinized (0, 1, or 2). Table 13 shows the numbers of innovations in each of these three groups, by type of innovation.

The data indicate that about 34.4 percent of the telephone cases fell into the

[1] Of the original ten passages and cycles, questions on changes in organizational governance (No. 6), promotion of personnel acquainted with the innovation (No. 8), and turnover in key personnel (No. 9), were eliminated from the analysis because of this problem. If these same passages or cycles were eliminated from the case study data, the results for the case studies would have been altered, but only slightly: The Miami and Boston police computer cases would have dropped from highly to moderately routinized, and the Rochester and Omaha Jet-Axe cases would have increased from moderately to highly routinized; all the remaining cases would have remained in their original rankings.

Table 13

Routinization Ratings for 90 Innovations
(Telephone Interviews)

Type of Innovation	Rating		
	Highly Routinized	Moderately Routinized	Marginally Routinized
Police Computer	3	7	3
MICU	4	8	4
CAI	5	5	6
CCTV	5	6	3
Jet-Axe	6	8	1
Breath Testing	8	7	1
Total	31	41	18

highly routinized category, 45.6 percent into the moderately routinized category, and 20.0 percent into the marginally routinized category. Among the types of innovations, the breath testing and Jet-Axe cases tended to be more routinized, and the police computer and CAI cases tended to be less routinized. In contrast to the case studies, it should be remembered that these telephone interview results were based on a random sample of innovations. Thus, the distribution of routinization outcomes may be considered representative of the universe of innovations adopted, as defined in Chapter 1.

Routinization and the Age of an Innovation

The first question that followed the assembling of these routinization scores and ratings was whether there was a simple relationship between routinization and the chronological age of an innovation. The older innovations might have been the more routinized ones, and this alone might have accounted for the pattern of scores.

In order to examine this proposition, the data from the case studies and telephone interviews were both arrayed along two dimensions: the median age of all the innovations[a] versus the degree of routinization. Table 14 shows that the hypothesized relationship did not exist. For the case studies, the age of innovation made no difference in predicting the degree of routinization; for the telephone interviews, there was even a slight tendency in the opposite direction—i.e., the younger innovations tended to be more routinized. In sum, the degree of routinization was not related to the chronological age of the innovation.

[a] The median age was defined separately for case studies and telephone interviews *and for* each type of innovation. Thus, for instance, the age of a particular telephone Jet-Axe interview was compared to the median age of all telephone Jet-Axe interviews. Other definitions of age were also tested (e.g., simply comparing all innovations four years or older versus those younger than four years), but these did not alter the results. The reader may wish to further examine the age dimension by tabulating the age of the 19 case studies as presented in Table 6.

Table 14

Age of Innovation by Degree of Routinization

Source of Evidence	Degree of Routinization		
	Marginal	Moderate	High
Case Studies (n=19)			
Above median age[a]	2	3	4
Below median age	2	4	4
Telephone Interviews (n=82)[b]			
Above median age[a]	12	20	13
Below median age	5	17	15

[a]Median defined independently for each type of innovation.

[b]No information on age for eight cases.

B. ROUTINIZATION AND DIFFERENT TYPES OF INNOVATIONS

Relationship to Six Types of Innovations

A preliminary examination of these scores and ratings from both the case studies and the telephone interviews revealed that *there were no systematic variations among routinization outcomes when the six different types of innovations—police computer, MICU, CAI, CCTV, Jet-Axe, and breath testing—were compared with each other.* This is an important observation, because a potential conceptual limitation of the passages and cycles framework was the degree to which certain passages or cycles might have been irrelevant for some types of innovations. If certain passages or cycles were irrelevant to the use of Jet-Axe, for instance, the Jet-Axe scores would have been artificially lower than those of the other innovations. An item analysis for each of the ten passages or cycles, however, showed no such irrelevancies, with one exception—rules of organizational governance may not be expected to change as a result of the use of the Jet-Axe, and indeed, this passage was not achieved by the two Jet-Axe case studies. However, even if the routinization scores for these two case studies were to be adjusted for this irrelevant passage (see Table 12), the overall rating of the innovations would not be different.[3]

Another potential example of this problem might be (incorrectly) inferred from the case study data (Table 12) where, for instance, there was a tendency for the police computer cases to be among the highly routinized and the CCTV cases to be among the marginally routinized innovations. Such a result could have reflected

[3] It should be remembered (from footnote 1 of this chapter), that the governance passage was one of three omitted from the routinization scores for the telephone interviews for *all* types of innovations, due to measurement difficulties. Thus, the Jet-Axe cases were no different from the other innovations in the final routinization score.

some inherent bias in applying the passages and cycles framework to these two types of innovations, independent of the actual degree of routinization that had occurred in each case. However, this pattern tended to be reversed in the telephone interview data (Table 13), so that there is little support for the original inference. Moreover, the overall association between the type of innovation and degree of routinization in the telephone interviews was weak and not statistically significant. It therefore seems that the passages and cycles framework did not create any artificial (and undesirable) discrimination among different types of innovations. Nevertheless, a distinction should be made between the conceptual biases (which, it is argued, are few) and the measurement problems (which, as indicated by the difficulties in defining some of the passages and cycles in the telephone interviews, need to be overcome in a more effective manner in future studies).

Where the types of innovations did make a difference was in explaining how routinization occurred. Thus, although there was no distinctive variation in routinization outcomes according to the six types of innovation, the degree of routinization appeared to have been achieved for each type for slightly different reasons. These differences were suggested in the previous three chapters. However, the major generalizations seem to be related to the three groups of innovations described in Chapter II:

- Task-specific innovations.
- Task-diverse (service-only) innovations.
- Task-diverse (service and administrative) innovations.

(It should be recalled that the Jet-Axe and breath testing innovations were intended to represent the first group; the MICU and CCTV innovations, the second; and the CAI and police computer innovations, the third.)

Task-Specific Innovations

What is important about the three groups is that different factors were predicted to be important for each group. Thus, the three groups were not by themselves predicted to be differentially associated with routinization. Rather, within each group, a full range of routinization scores and ratings was possible. The main predictions were that different organizational conditions would be important in accounting for the degree of routinization within each group. For the task-specific innovations, the general conditions were hypothesized in Chapter II to include: widespread practitioner acceptance, visible service payoffs, and minimal retraining needed for practitioners. The findings are consistent with these initial hypotheses.

Widespread Practitioner Acceptance. First, a major limitation of task-specific innovations was that they could not (by definition) be used for a variety of applications to promote widespread practitioner acceptance. In fact, the Jet-Axe and breath testing innovations were each used to perform only a single major task—blasting through an especially difficult wall or barrier in one case, and testing DWI arrestees in the other. Because of this limitation, it was important that, for routinization to proceed, such tasks were performed as frequently as possible in an agency's daily work activities. Thus, the innovation's inherent limitations in performing a *diverse* array of applications was compensated by a *repetitive* number of occasions upon which the single relevant application was performed. Many of the

limitations of the Jet-Axe appeared to stem from the fact that the innovation could not be used for a diverse set of applications, but the single application for which it is relevant also did not occur very frequently in firefighting activities. Under such conditions, it was difficult to establish widespread practitioner acceptance simply because few practitioners had opportunities to use the innovation. Breath testing innovations, in contrast, were also limited to a single application, but DWI arrests occurred frequently in a police department's everyday activities.

Visible Service Payoffs. Second, the experiences with the two task-specific innovations showed that the important characteristic of service payoffs was that they be "visible" from the practitioner's viewpoint. The payoffs did not have to be reflected in the measures commonly used by evaluation researchers. For instance, cost-savings may be a significant payoff identified by an external evaluator, but such savings are not necessarily the relevant measures for practitioners. (Among other things, cost-savings by a public agency may not be visible to the individual practitioner.) What was more important was that, in the eyes of practitioners, the innovation produced a concrete improvement in performing a specific task—whether by improving performance or by reducing the time, physical effort, inconvenience, or even distastefulness involved in performing the task. Thus, the adoption and implementation of a task-specific innovation is actually the collective result of individual decisions made by individual practitioners; each practitioner may even be regarded as a separate adopter, whose actions can undermine or facilitate an agency's initial decision to adopt an innovation.

Retraining for Practitioners. The case study results did not strongly support the hypothesis that for task-specific innovations, routinization would more likely occur if the needs for practitioner training were minimal. The breath testing innovation, for instance, involved considerable training, certification, retraining, and recertification requirements; furthermore, individual practitioners also became senior operators—i.e., persons certified to *teach* others to become breath testing operators. A task-specific innovation could, in short, involve complex and extended retraining. Practitioners enthusiastically undertook such retraining where the perceived payoffs were sufficient and where ample time and opportunity were set aside for the retraining experience

Task-Diverse Innovations

The two remaining groups of innovations were clustered together because of the finding that competition for an innovation's resources by different applications did not appear to play an important role in the routinization process. It had been hypothesized that, for task-diverse (service and administrative) innovations, strong competition between the service and administrative applications would reduce the tendency toward routinization. This group of innovations was therefore to be distinguished from task-diverse (service-only) innovations. However, the case study evidence indicated that competition could also occur among the service applications, even where no administrative applications existed. Such competition did not differ from that between service and administrative applications. Similarly, analysis of the telephone interviews also indicated no differences on this point. For this reason, the two groups of task-diverse innovations did not appear to be as different as

originally postulated, and they are treated as a single group in all subsequent discussions.[4]

For the task-diverse innovations, the general conditions that appear to influence the routinization process were hypothesized in Chapter II to include: support from agency administrators, a large number of service applications, support from a core group of practitioners, an active innovator to promote applications, and ample opportunities for practitioner training. In general, these conditions overlap with the ten hypotheses suggested as important for all types of innovations, and these conditions are therefore covered in the next subsection. However, several conclusions that appear to be specific to task-diverse innovations can be made at this point.

Role of the Coordinator. First, although all types of innovations may benefit from a strong and capable coordinator, the role was more important for task-diverse than for task-specific innovations. This is because the former by definition involved a variety of potential applications and hence a variety of organizational actors and procedures that needed to be coordinated. Thus, whereas the need to coordinate a task-specific innovation such as the Jet-Axe could be accommodated within the everyday duties of the chief of a fire department, and breath testing innovations could be coordinated by an officer such as the commander of the traffic division (who also had many other duties), task-diverse innovations such as CCTV or CAI all required a senior official whose full-time duties were the coordination of the particular innovation. The coordinator did not have to be the same person as the innovator, who had initially garnered the support needed to adopt and implement the innovation; the coordinator, however, was likely to fill a new role within the organization. This meant that the successful passage related to new personnel classifications was more important for task-diverse rather than task-specific innovations.

Practitioner Support. Second, because the task-diverse innovations involved a number of applications, and because a different group of practitioners was likely to be connected with each application, the task-diverse innovation could ultimately derive support from a variety of practitioner groups. Such support occurred if the practitioners were pleased by their experiences with the innovation, and if new job assignments and professional development opportunities were increased. (Note that these payoffs were still not those generally used by external evaluators.) Thus, the task-diverse innovations had a potentially different base of support from that of task-specific innovations. For instance, CAI systems derived support from mathematics teachers, science teachers, or other school staff, depending upon which applications were attempted in any given school district. What was important was the intensity of support from the relevant subgroup rather than, as in the case of task-specific innovation, widespread support throughout the agency.

Increase in Applications. Third, task-diverse innovations had a greater possibility for diversification and growth than task-specific innovations. This meant that purchases of new generations of equipment had to be planned carefully to anticipate increased needs. At the same time, premature purchases had to be

[4] This finding may still need further testing. It may be that the distinction becomes important when more than one agency or jurisdiction is involved with the innovation. However, because such cross-agency or cross-jurisdictional arrangements were deliberately excluded from the present study, the distinction between the two groups of task-diverse innovations may not have been given a fair chance to emerge.

avoided, and new generations of equipment could not be added so fast that agency personnel had little chance to get accustomed to the new equipment. In general, the addition of new applications had to be continually balanced against the acquisition of new equipment, and this activity required a continued attention and skill that was not needed for task-specific innovations.

Summary

The results showed that no simple relationships existed between the six types of innovation and the degree of routinization. The type of innovation did make a difference, however, in explaining how routinization took place, and here the key distinction was between task-specific and task-diverse innovations. The task-specific innovations were much more heavily dependent upon a high frequency of use, visible payoffs to individual practitioners (which were not necessarily the same types of payoffs identified by managers or evaluation research teams), and somewhat independent adoption decisions by individual practitioners. The task-diverse innovations, in contrast, relied more heavily on the role of a full-time coordinator, needed to draw intensive practitioner support but from smaller groups of practitioners, and needed to be carefully managed in relation to the acquisition of new equipment. The research implications of these two different experiences with task-specific and task-diverse innovations will be described in Chapter VIII.

C. FACTORS ASSOCIATED WITH ROUTINIZATION

The earlier description of the passages and cycles framework included ten factors that were hypothesized to facilitate routinization (see Chapter III). Briefly, the ten factors were that an innovation covered or had:

1. *Core application* in an agency's activities.
2. *Minimal competition* for resources among different applications.
3. *Service payoffs.*
4. *Prior need,* either from crisis conditions or chronic service deficiencies.
5. *Client support* (support from residents who directly benefited from the innovation's output).
6. *Community support* (support from residents in the community as a whole).
7. *Top administrative support* within the agency.
8. *Practitioner support* within the agency.
9. *Active innovator support.*
10. *No adversary group* that specifically opposed the innovation.

All ten of these factors were examined as part of each of the 19 case studies. In addition, questions concerning most of the ten were included in the telephone interviews. Throughout, the analysis consisted of simple associations between each factor and the degree of routinization. Because of the crude measures used (most were nominal or ordinal scales), no attempt was made to conduct any multivariate analysis (which generally requires ordinal and integral scales).[5] The findings should

[5] For an example of the multivariate regression or correlational techniques that can be applied to organizational studies when the appropriate measures have been developed, see Yin, Heald, and Vogel (1977).

therefore be considered as forming the basis for further testing when better measures have been developed.

Case Study Results

Review of Individual Hypotheses. The results may first be discussed for the case studies. To facilitate the discussion, Table 15 summarizes the presence or absence of each factor for the 19 case studies. For two of the factors (*minimal competition* and *active innovator*), there was not much variation among the case studies, with most having both conditions present (16 out of 19 case studies for the former, and 17 out of 19 for the latter). Thus, nothing conclusive can be drawn about these two factors in distinguishing among the three degrees of routinization, but it may be that both factors must be present in all cases to facilitate any type of routinization.

Three other factors had sufficient variation but no apparent relationship to the degree of routinization. These included the presence of *service payoffs* and *client support*, and the absence of an *adversary group*. Of these factors, it should be pointed out that in only one case study (Cincinnati, breath testing) was there a formal evaluation effort to define the service payoff. In all the other cases that had a payoff, the presence of the factor was based on informal reports to the case study team of the perceived savings or gains that had been made.

Of the remaining factors, two had a weak relationship to the degree of routinization (*prior need* and *community support*). The prior need factor could have been based on either a crisis or emergency situation (e.g., Birmingham's fatalities that led to increased demand for an MICU system) or a chronic and gradually eroding situation (e.g., the rising crime rate in Indianapolis that increased the need for a computer-based reporting system, or the slowly rising rate of traffic accidents in Akron that led to increased concern with drunken driving). However defined, the prior need factor was only important because it was notably absent among the marginally routinized cases; it was not a frequently present factor in the highly routinized cases. The community support factor appeared only weakly related to routinization because of the small number of case studies for which this factor was relevant. Residents in general, it should be recalled, were not found to be aware of such innovations as police computers, CAI, or even breath testing. Given a low level of awareness of an innovation, little support from a community can be expected.

Finally, *three factors appeared to have a substantial relationship to the degree of routinization*. These were the use of the innovation for a *core application*, the presence of *top administrative support*, and the presence of *practitioner support*. For the core application factor, the case studies are almost arrayed precisely, with the exception of the Boston (police computer) and Memphis (breath testing) cases. In Boston, the computer system was not regarded as having involved core applications because most of the computer applications did not affect the everyday operation of the agency; in Memphis, a core application had evolved, but the situation was only marginally routinized, perhaps because the breath testing operation was not formally a part of either the police department or the sheriff's department but was shared by the two.

For the administrative support factor, the case study results were also in the predicted direction, but with three exceptions: Nashville (police computer), Dallas

Table 15

Presence of Ten Factors Hypothesized to Facilitate Routinization[a] (Case Studies)

Degree of Routinization/Site[b]	Type of Innovation	Ten Factors Hypothesized to Facilitate Routinization									
						Strong Support for Innovation by:					
		Core Application	Minimal Competition	Payoffs[c]	Prior Need	Clients	Community	Administrators	Practitioners	Active Innovator	No Adversary Group
High											
Indianapolis (10)	PC	+	+	+	+		+	+	+	+	+
Birmingham (9)	MICU	+	+	+	+	+	+	+	+	+	
Dallas (9)	CAI	+				+		+	+	+	+
San Diego (9)	CAI	+		+			+	+	+	+	+
Nashville (8)	PC	+	+	+		+			+	+	
Miami (7)	PC	+	+				+	+		+	+
Boston (7)	PC		+	+				+		+	
Cincinnati (7)	BT	+	+	+	+			+	+	+	+
Moderate											
Akron (6)	BT	+	+	+	+	+		+	+	+	+
Dallas (6)	MICU	+	+	+	+	+	+		+	+	
Rochester (6)	J-A		+	+				+		+	+
Omaha (5)	J-A		+	+	+			+		+	+
Tampa (5)	CAI									+	+
Memphis (4)	BT	+	+	+		+			+	+	+
Portland (4)	CCTV		+							+	+
Marginal											
Oakland (2)	CAI		+								
Omaha (2)	CCTV		+			+				+	+
Rochester (2)	CCTV		+					+			
Denver (0)	MICU		+	+			+			+	

[a] The presence of these factors is indicated by a plus (+) symbol in the table.

[b] The routinization score for each site is shown in parentheses.

[c] "Perceived" payoffs, not the result of any evaluation (see text).

(MICU), and Rochester (CCTV). In both Nashville and Dallas, agency officials were not enthusiastic about the innovation at first. However, there was considerable support for the innovation by officials in the executive or legislative branches outside the agency, and officials within the agency eventually accommodated it. In the Rochester case, the CCTV system received extremely strong support, although the system only became marginally routinized.

For the practitioner support factor, there were also three case studies that were exceptions to the predicted relationship: Miami and Boston (police computer), and Memphis (breath testing). In Miami and Boston, neither site developed extensive on-line use of the computer system at the time of the case study, hence few practitioners had opportunities to use the system. However, in both cases there were reasons to believe that this situation would change, because both sites were installing newer computer systems. The Memphis exception reflected the same condition previously described—the innovation appeared to have had many factors facilitating routinization but such an outcome was perhaps delayed by the hybrid organizational status of the breath testing unit.

Summary Interpretation. The relationships of these individual factors to the routinization outcomes supported the conclusion that, for routinization to occur, every innovation needed some person(s) in the agency to serve as an active innovator. The importance of the innovator was reflected by the fact that the majority of the case studies (17 out of 19) had a person(s) who brought information about the innovation into an agency, developed internal support, and helped to promote the conditions necessary for the agency's initial use of the innovation. The innovator was not necessarily the adopter (who made the decision—if it was a singular decision—to try the innovation within the agency) or the coordinator (who ultimately guided the actual use of the innovation), or a single individual (several people often shared the role). The innovator or innovative team was nevertheless the initial point of entry into an agency for initiating a new practice.

Given an active innovator, an innovation was more likely to become routinized if it involved a core application and had the support of other persons *within* the agency—i.e., the top administrators and some practitioner group. Some external conditions, such as the prior need for the innovation or community support for it, only weakly affected routinization; other external conditions, such as client support, did not appear to affect routinization. The general pattern of results therefore supported the overall interpretation that, *as long as an innovation covered a core application, the main factors facilitating or retarding routinization were internal and not external to the agency.* Innovations appeared not to become routinized without acceptance by practitioners and support from top administrators.[6]

The potential importance of the core application attribute should not be overlooked. An innovation covered a core application if it displaced some existing function (e.g., substitution of computer for manual operations) or if it was a new function that publicly redefined the basic mission of an agency (e.g., expansion to firefighting services supplemented by emergency rescue). If a policymaker is interested in encouraging innovation, the first task should thus be to focus on those innovations that involve core applications. Many innovations, such as CCTV, may

[6] It should be noted that the study has only been concerned with routinization. Thus, no inferences should be made regarding the factors facilitating *adoption*. There may have been any number of such factors, but these were not examined as part of the present study.

only *potentially* involve core applications and must therefore be explicitly designed at any given site to cover such applications. This might be done by integrating the use of CCTV with the mandated curriculum—e.g., the regular English classes that cover reading, spelling, or grammar. If explicit attempts are not made, the innovation may only involve elective courses—or worse yet, no formal courses at all—and is less likely to become routinized.

Telephone Interview Results

The telephone interviews also included questions covering six[7] of these ten factors. This allowed a further checking of the preceding findings but through the use of the 90 telephone sites rather than the 19 case studies.

The analysis involved the coding of the six factors as present or absent for the innovation at each site, based on the relevant questions in the telephone interview. The results were then arrayed in a 2×3 matrix for each factor (presence or absence of the factor versus the three degrees of routinization as previously defined in Table 13). The arrays or contingency tables were subjected to associational analysis, with gamma scores (which can range from -1.00 to 1.00) used to measure the strength of the relationship between the factor and routinization.[8] These gamma scores are shown in Table 16.

The pattern of scores indicated general agreement with the case study findings. Basically, those findings had shown that three factors—the use of the innovation as a core application, top administrative support, and practitioner support—were most closely associated with increased routinization. The telephone interview results in Table 16 were similar to the case study findings because two of these same factors had the strongest relationship to routinization (even though one of the statistical differences was only significant at the $p < 0.10$ level), while the third factor was one of those that had no applicable data. In short, *the data from the 90 sites also showed that the core application and practitioner support factors were related—albeit weakly—to increased routinization*, and that none of the other factors appeared to have made much of a difference.[9]

D. ROUTINIZATION AND EXTERNAL SUPPORT

The main conclusion from the case studies and the telephone interviews has been that routinization was largely affected by internal rather than external factors. This general theme was reinforced by an examination of two other external factors that policymakers have typically hoped would facilitate the use of innovations: external financial and technical assistance.

Among the case studies, external financial assistance was defined in three ways.

[7] The other four factors could not be covered due to the problems of defining the factors adequately in a telephone interview.

[8] A gamma score can vary from 1.00 (perfect positive association) to -1.00 (perfect negative association), and thus has the same interpretation as a correlation coefficient (r). The gamma statistic, however, is used whenever data involve ordinal and nominal scales, as in the present study.

[9] As previously noted, no multivariate analysis was attempted because of the weakness of the measures. However, simple associational analysis (independent variable $\times$ independent variable) was conducted and showed that this basic result—the importance of the core application and practitioner support factors—appeared not to be an artifact of strong collinearity between the two factors (in which case one might argue that only one factor was really important).

Table 16

Relationship Between Ten Factors and Degree of Routinization
(Telephone Interviews)

Factor	Association between Factor and Routinization Rating		
	Gamma Score[a]	Degrees of Freedom	(χ^2)[a]
Core Application	.59	2	5.30[b]
Minimal Competition	-.37	2	4.21
Service Payoffs	-.15	4	2.85
Prior Need	n.a.	-	-
Client Support	n.a.	-	-
Community Support	.11	10	8.97
Administrative Support	n.a.	-	-
Practitioner Support	.58	2	7.16[c]
Active Innovator	n.a.	-	-
No Adversary Group	.20	2	1.66

[a]The gamma score indicates the strength and direction of the relationship between two variables, with the possible scores ranging from 1.00 (perfect positive association) to -1.00 (perfect negative association). The χ^2 is used to give the reader some idea of the level of statistical significance of the gamma score, even though the collection of telephone interviews was not a random sample. The χ^2 levels should therefore only be used as a guideline for interpreting the data.

[b]$p < 0.10$

[c]$p < 0.05$

n.a. = no available data (see text for explanation)

The first covered the use of federal or state (but not local) funds, where such funds were the main support in initiating the innovation; the second, funds for discrete projects preceding adoption; and the third, funds for discrete projects after adoption. The distribution of the case studies according to these three definitions was shown in Chapter IV (see Table 7), and these same data are repeated in Table 17 but with the case studies now arrayed according to their degree of routinization. The data show that there was little relationship between the use of external funds (for whichever of the three definitions) and the degree of routinization. A similar analysis was conducted for technical assistance, with no relationship found between the presence of such assistance and routinization. This is not to say that either funding or technical assistance was unimportant in individual cases—just that it made no difference in the pattern of scores for the entire group of cases.

Among the telephone interviews, there were also questions covering external financial support and external technical assistance. The gamma scores indicating the association between these factors and the routinization outcomes are shown in Table 18. The results show that there was no statistically significant relationship between either of these external factors and routinization. (The use of external funds was defined in terms of the presence of funds at any time in the innovation's

Table 17

Relationship Between Presence of External Funds and Routinization Outcomes[a]

Degree of Routinization/Site[b]	Type of Innovation	Use of External (State or Federal) Funds		
		External Funds Used as Main Source of Initial Funds	External Funds for Specific Projects before Adoption	External Funds for Specific Projects after Adoption
High				
Indianapolis (10)	PC			
Birmingham (9)	MICU	+		
Dallas (9)	CAI	+		+
San Diego (9)	CAI		+	+
Nashville (8)	PC	+		
Miami (7)	PC			+
Boston (7)	PC			+
Cincinnati (7)	BT	+	+	+
Moderate				
Akron (6)	BT			+
Dallas (6)	MICU	+		+
Rochester (6)	J-A			
Omaha (5)	J-A			
Tampa (5)	CAI			
Memphis (4)	BT	+		+
Portland (4)	CCTV	+		
Marginal				
Oakland	CAI			+
Omaha	CCTV	+	+	+
Rochester (2)	CCTV	+		+
Denver (0)	MICU	+		

[a]The presence of these funds is indicated by a plus (+) symbol in the table.

[b]The routinization score for each site is shown in parentheses.

life history; technical assistance was defined in two ways—initial and continuing technical assistance.)

The findings from both the case studies and the telephone interviews indicated that *external assistance—whether in the form of financial or technical assistance—was unrelated to the degree of routinization.* This finding was congruent with the conclusions regarding the importance of internal factors from the previous discussion covering the ten hypotheses.

One possible explanation for why the external factors may not be a significant correlate of routinization comes from the case studies. In the case studies, it was observed that some external assistance resulted from requests, proposals, or other initiatives taken by local officials; on some occasions, as in the Birmingham (MICU) case, the officials even actively and continually sought such support, although an initial grant request had been turned down. Other external assistance (financial and technical), however, resulted from initiatives made by a person outside the agency. Such an outsider could have been a federal official, a state or county official, or a

Table 18

Relationship Between External Factors and Degree of Routinization
(Telephone Interviews)

Factor	Association between Factor and Routinization Rating		
	Gamma Score[a]	Degrees of Freedom	(χ^2)[a]
Presence of External Funds at Any Time in the Innovation's Life History	-.05	2	1.67
Presence of External Technical Assistance to Initate the Innovation Only	-.22	2	1.20
Presence of External Technical Assistance on a Continuing Basis	-.05	2	0.07

[a]See Table 16 for definition. None of the χ^2 scores is statistically significant.

member of a private vendor (e.g., computer firm). Whether external assistance followed from local or external initiatives might have had strongly contrasting effects on routinization. Yet, it was very difficult to establish the actual facts regarding who had initiated what. The data collection measures merely noted the presence or absence of external assistance but did not distinguish among the initiating agents, which may therefore account for the failure to find any relationship.

E. ROUTINIZATION: WHAT IT ALL MEANS

The Meaning and Incidence of Routinization

Organizational change ultimately involves the process by which new practices become standard business in a local agency. Whether the process is called routinization, institutionalization, incorporation, or some other term, it is central to all organizations, not just local agencies. Moreover, any attempt to deal seriously with organizational change must be concerned with this long-term perspective. In the past, too much attention has been paid to the initial phases (adoption and implementation) in the change process, often to the detriment of an organization, which may have suffered many short-term disruptions but gained no long-term benefits. It has also been argued that the routinization of new practices has become a particular concern of local agencies because of the changing urban conditions in this country. Many traditional agency practices in education, public safety, and other neighborhood services have been made obsolete, and both local and federal officials have pressed for change. But in dealing with local agencies and their

political and social environment, it is doubly important to be concerned with long- and not just short-term effects.

The main contribution of this study has been to describe, in operational terms, the routinization process. Because this has not been done before, the study has necessarily relied more on observations from a set of 19 case studies, but corroborating evidence has also been presented from a set of 90 telephone interviews with local officials. The case study observations allowed for a more flexible probing of local conditions, even though each case study followed the same basic outline, which was necessary for later aggregation. The operational terms in which routinization has been described are based on ten passages and cycles—the key events in the life history of a specific, innovative practice.

The point at which a practice becomes "routinized" cannot be defined in any absolute sense. In fact, any organizational practice, no matter how longstanding, is always susceptible to replacement by some innovative procedure. This is both the dynamic and frustrating nature of organizational life. Rather than search for an absolute definition, this study's approach has been to distinguish among three relative degrees of routinization—innovations that have become highly, moderately, and only marginally routinized. The innovations that were defined as highly routinized were those that developed local budgetary support, formed appropriate personnel classifications and organizational identities to sustain the innovation, established supply and maintenance procedures, and coped with the inevitable process of equipment replacement and upgrading as innovative practices expanded. Such innovations also accomplished other passages and cycles not generally achieved by the moderately or marginally routinized innovations. For instance, regular training programs to teach practitioners to use the innovation were established; personnel who supported the innovation were promoted into the higher ranks of the organization; rules of organizational governance were frequently changed to accord the innovation an integral role in the agency's mission; and there was even turnover among the key personnel operating the innovation, indicating that the new practice had not been dependent on a specific set of individuals. These were the conditions—i.e., passages and cycles—that characterized routinization.

In addition to the creation of the passages and cycles framework, another key to the study has been the identification of a specific set of innovations, and the tracing of the life histories of these innovations in individual agencies. The life histories have been divided into three periods of time: the Improvisation Stage (during which the innovation becomes operational and new practices are actually established in the local agency), the Expansion Stage (during which the first set of key passages and cycles occur), and the Disappearance Stage (during which the innovative practice remains but becomes so much a part of normal practice that it is no longer regarded as an innovation). The life histories in our sample of case studies often extended over a period of 10 to 15 years to cover all three stages. For this reason, a deliberate choice made in the study design was to identify and select a sample of "old" innovations, and then to trace life histories in a post hoc or historical manner. Although organizational memories may be difficult to tap, this procedure avoided the even greater uncertainties that follow from tracing "new" innovations forward in time.

On balance, it was found that a large percentage of the innovations had attained the status of being "highly routinized." Eight out of 19 case studies (42.1 percent) and 31 out of 90 telephone sites (34.4 percent) fell into this category; conversely, 21.1

percent of the case studies and only 20.0 percent of the telephone sites fell into the opposite category of "marginal" routinization. These results are notable in two respects. First, they indicate that many innovations in these two samples—one a stratified sample (the case studies) deliberately chosen to create variation in routinization outcomes, and the other a random sample (the telephone interviews)—have lasted and become a virtual part of standard practice. Such encouraging results mean that local agencies can innovate and may not be the bastions of "resistance to change" that they have been typically construed to be.

Second, the percentage of highly routinized innovations is much higher than that found in a recent study of federal innovations in education (Berman and McLaughlin, 1977 and 1978). That study found that none of the innovations had lasted longer than the period of initial federal funding, thereby leaving a much more pessimistic view of innovation. The apparent discrepancy in findings may have two rather simple explanations. First, the present study has focused on *technological* innovations, whose hardware components were easier to trace than the organizational innovations that marked the Berman and McLaughlin study. The choice of technological innovations, as described in Chapter II, was deliberately made to facilitate the life history approach.[10] Second, this study has also sampled from innovations that had not necessarily been initially supported by federal funds. In fact, about half of the innovations in the case studies were locally initiated and supported. From the local perspective, then, many innovations can be and have been adopted, implemented, and routinized. These simply may not be the innovations included on the agendas of federal agencies.

The Conditions that Lead to Routinization

The major conditions that lead an innovation to become routinized all appear to be internal to the specific local agency. This is not necessarily an unexpected outcome, but it does suggest that external initiatives (as in a federally initiated agenda) are either limited or will have to be designed with a greater degree of sophistication.

The specific internal conditions involve the role of an innovator (or innovator-team), who must develop agency support for the innovation and establish the appropriate skills and resources for initially operating it. Among the other important initial conditions, some group of agency practitioners must be trained to use the innovation and to begin using it as frequently as possible, preferably in relation to regular agency practices rather than as a special project.

Routinization is now likely to proceed further if the innovation becomes part of a core agency practice. One way of defining a core practice is if the innovation displaces an old practice. Under this definition, the new practice can be routinized more effectively if the capability for carrying out the old practice is systematically removed after the new practice has been installed. This dual tactic is often forgotten by those supporting an innovation, who rightly focus on installing new practices but who negligently fail to attend to the policies needed to terminate the old practices. Another way a core practice is established is when the innovation expands the agency's original array of services. Under this definition, the new practice can be

[10] Unfortunately, the Berman and McLaughlin study included few technological innovations, so there was almost no overlap in the samples of that study and this one.

routinized more effectively if the expanded array is formally recognized in a revised version of the agency's mandate. Thus, those supporting the innovation must work for changes in an agency's rules of governance, as reflected in a city ordinance, a bond issue's definition of the standard practices that may be financed, or even a perceptual shift reflected in a new agency name or defense in municipal budgetary reviews.

Throughout its early life history, an innovation must continually gain increased support from agency practitioners. This support will result in part if the innovation covers a core practice. However, the innovation must also operate effectively. Here it may be important to distinguish between task-specific and task-diverse innovations. For the former, an effective operation must usually be proven in terms of the individual practitioner's own use of the innovation. Furthermore, some of the criteria by which the practitioner judges an innovation—e.g., convenience, reduced physical effort, additional sense of safety on the job, or elimination of distasteful tasks—are different from those typically held by external evaluators. Thus, for task-specific innovations, external evaluators will not always predict correctly whether there are service payoffs. For task-diverse innovations, the role of the coordinator becomes critical; one of the major objectives of the coordinator is to identify specific applications and practitioner groups to which the innovation can be directed. Practitioner support may thus come from any number of subgroups in an agency but is still not likely to be based on the programmatic criteria—e.g., response time, lives saved, changes in student achievement—typically used by external evaluators. (The findings showed that these types of service payoffs and any external evaluations played a negligible role in routinization.) One possibility is that the task-diverse innovations draw practitioner support to the extent that the innovation provides an expanded employment base—i.e., more jobs or job assignments. Naturally, the new work must be compatible with the practitioner's professional status and aspirations. The main point is that there may be bureaucratic rather than service efficiency incentives at work, and little is known about the bureaucratic incentive system.

Finally, an important internal condition is the specific support of top agency administrators. These administrators are usually an essential part of the key decisions about an innovation—e.g., to adopt and undertake it, to make staff available on some ad hoc arrangement (e.g., overtime or special hours), or to make budgetary funds available each year. Without administrative support, most innovations will fail to become routinized (the main exceptions are the task-specific innovations that may initially be adopted by individual practitioners at no cost to an agency). The administrators appear also to respond to bureaucratic incentives. If an innovation permits an expanded agency budget, for instance, the administrator may have a strong incentive for routinizing the innovation. However again little is known about the bureaucratic incentive system of top administrators, especially given the confluence of actors—e.g., union representatives, staff from the municipal executive's office, and local legislators who are involved in determining agency policies.

In contrast to these internal conditions, external financial and technical assistance were consistently found to be unrelated to the degree of routinization. This does not mean, however, that local agencies can or will innovate as easily without such external assistance. More likely, the lack of relationship was due to the inability to distinguish between two very different conditions—where local officials active-

ly pursue external assistance and where such assistance is the result of initiatives by a federal granting agency or other external agent. External assistance may in fact be important to routinization if such assistance matches local needs and agendas. Further research is needed, however, to identify the initiating official and the extent of match between external and local agendas.

Overall, these findings and observations may lead to an improved basis for dealing with routinization in the future. In particular, there may be some ways in which federal policymakers can avoid the extreme positions of appearing to impose federal agendas on local agencies, or merely distributing funds on a formula and revenue-sharing basis. The first extreme can lead to undesired clashes and a failure to deal with local needs in the long run. However, the second extreme can lead to a failure to innovate at all, even where innovation appears needed. Further research on the design of more effective strategies is the subject of the final chapter.

Chapter VIII

DIRECTIONS FOR FUTURE POLICY RESEARCH

The discovery of how new practices become routinized by local service agencies can potentially lead to more effective public policies—whether to facilitate or inhibit routinization. To the extent that the present study has broken new ground, however, the main findings still require corroboration by further research. New studies should especially focus on the *passages* and *cycles* framework with regard to other innovations and life histories; this and other specific suggestions for future research are the topic of this chapter.

The main purpose of further research would ultimately be to provide advice to improve public policy. Thus, the general direction of future research should be to sharpen the key conclusions and to apply them to specific policymaking needs. The following discussion covers the dual nature of the policy audience, further research on routinization strategies, and further research to facilitate the role of federal mission agencies.

A. DUAL NATURE OF THE POLICY AUDIENCE

Public policy regarding local services has traditionally been a strictly local matter—i.e., determined by the political and administrative priorities within each local jurisdiction. Any policy lessons on routinization would thus ordinarily be directed to municipal executives and legislators, local agency heads, and staff persons who serve as coordinators for specific innovations. Because local services are still controlled by such decisionmakers, this is the main audience for whom new policy research must continue to be designed.

A second policy audience, however, has become more important with the increased participation of federal (and to a lesser extent, state) agencies in local service delivery. In some fields, such as highway construction, this type of participation has existed for some time. In other fields, such as education, law enforcement, and fire-suppression, federal participation has been relatively new and has followed the enactment of major legislative initiatives—e.g., federal aid to education (1965), federal law enforcement assistance (1968), and recently enacted legislation on fire safety administration (the National Fire Prevention and Control Administration in the Department of Commerce). As a result, there are now any number of federal decisionmakers who are also concerned with improving the delivery of local services. Moreover, local service practices can now be substantially affected—though not always in predictable ways—by the actions of these federal officials. Future policy research should therefore also attempt to serve this second group of decisionmakers, who may include federal mission agency heads and their staffs.

These two policy audiences operate from two different perspectives.[1] For this reason, two somewhat different research agendas need to be developed. In general, further elaboration of specific routinization strategies is likely to be *directly* rele-

[1] A brief description of these differences is found in McLaughlin and Berman (1975).

vant to a local service agency and local decisionmaking needs to be only *indirectly* relevant to federal decisionmakers. The latter group will need to modify its own bureaucratic routinization processes through the use of federal policies in order to implement changes at the local level. Thus, the needs of this second policy audience also require further research on the efficacy of various federal policies. Such research is dealt with separately after the discussion on routinization itself.

B. FURTHER RESEARCH ON ROUTINIZATION STRATEGIES

The findings in Chapter VII have already been summarized in terms of the meaning of routinization and the conditions that lead to its occurrence. These findings may now be integrated into a broader depiction of the innovative process, to identify directions for future policy research. From the point of view of a local service agency, the key policy questions for adopting and routinizing an innovation might be framed in the following order:

1. When should innovative practices be considered? In other words, what service problems are most likely to be successfully dealt with by the initiation of new practices?
2. How should an innovation, once adopted, be used in order to increase the likelihood of routinization?
3. What organizational procedures must be explicitly changed in order to accommodate an innovation in increasing the likelihood of routinization?
4. What is the range of situations or innovations to which any of these guidelines can be generalized?

The research needs are presented according to this sequence of questions.

Research on the Adoption of Innovations

Local agencies are continually confronted with a wide range of problems, some dealing with basic service deficiencies (e.g., declining educational achievement scores) and others dealing with administrative management (e.g., a work overload in a clerical operation). At the same time, intermediary organizations (e.g., professional associations or extension and change agents), federal agencies, and industrial groups have identified a wide array of innovations, or presumed "solutions" to local problems. The local agency decisionmaker thus has a complex priority-setting problem: How should he or she determine what types of innovations are appropriate for what types of problems?

These initial questions regarding the criteria for *adopting* an innovation were largely ignored by the present study. This was a deliberate omission in the research design, because so much previous research had already focused on the adoption process. Such existing research has generally concluded that the adoption of an innovation is most appropriate when (see Rothman, 1974, pp. 417-483):

- The adopting agency has a professional staff structure, is less formally organized, and is decentralized.
- The innovation being adopted has a perceived relative advantage over and is less complex than other innovations or the status quo, is compatible with the adopting agency, and is easy to communicate.

- The use of the innovation is supported by opinion leaders and peers (practitioners) outside the adopting agency.

Further research on adoption is nevertheless needed. In particular, studies of adoption behavior have usually focused on the diffusion of specific innovations; what is needed instead is further study of local agencies and the situations or problems that give rise to the need to innovate. In short, whereas the typical adoption study has focused on solutions (i.e., innovations), more work is needed from the perspective of problems (i.e., needs).

Once a problem framework has been developed, one facet of the present study that might be explored in further studies of adoption is the distinction between *task-specific* and *task-diverse* innovations. When local needs have led to a task-specific innovation being considered for adoption (i.e., an innovation limited to a single service application), the more important criteria may have to do with practitioner receptivity and support. Research should focus on the importance of the following factors, which have been suggested by the findings in the previous chapter:

- The degree to which the innovation matches the priorities perceived by practitioners.
- The informal reaction of small groups of practitioners in the agency who have been given an opportunity to test the innovation.
- Evidence that the innovation was previously well received by practitioners in other jurisdictions.

A task-specific innovation is likely to go unused (even if agency management has "adopted" the innovation) if these factors tend to be negative.

In contrast, when a task-diverse innovation is considered for adoption (i.e., an innovation that is potentially relevant to a variety of service applications), the more important criteria may have to do with the staff capabilities for coordinating the innovation. Thus, research should focus on the following factors:

- The presence of a staff person who can serve as coordinator, which includes the ability to manage as well as to assist in repairing the innovation.
- The degree to which the innovation is of sufficient organizational significance that a coordinator who does well can be rewarded with one or more promotions while still working with the innovation.
- The presence of someone who can work with the coordinator (if not the coordinator himself) to identify the best array of initial service applications for the innovation, and who is sensitive to the development of intense (but not necessarily widespread) practitioner support for the innovation.

The supposition from the present study is that a task-diverse innovation is likely to fail if there is no capable coordinator or coordinating team, and if as a consequence there is heavy turnover in this role during the first few years in the innovation's life. Conversely, highly significant innovations can attract talented coordina-

tors, who may be able to grow with the innovation and to make substantial career advances based on success with the innovation.[2]

Research on Strategies for Routinization: I. Ways of Using the Innovation

No research can address the issue of whether, and under what circumstances, local agencies should seek to routinize a new practice. Thus, the present study has provided no information about the "appropriateness" of such a course of action; moreover, there are certainly many situations when the initial experiences with an innovation might be sufficiently negative that routinization should not be allowed to occur. At the same time, it is very difficult to specify for any given situation those innovations that should or should not be routinized. The diversity of local conditions and innovations precludes any general statements, and research can therefore offer few normative guidelines. Instead, the assumption throughout the text has been that agency decisionmakers have already deemed routinization desirable—i.e., that they have already decided to make an innovation part of standard agency practice. Given this decision, several findings from the present study appear worth corroborating in further research.

First, the findings have suggested that, *at the outset, it is essential for the innovation to become fully operational for at least a few complete tasks*, so that agency personnel can learn what the innovation can do. Only when an innovation is operational can it develop an identity that others, even if peripherally involved, can describe and to which existing agency practices can be related. Chapter IV pointed out that one way of better assuring that the innovation became operational was to limit its initial scope, so that only a subset of activities was performed or only a small portion of the agency was initially involved. This strategy has been referred to elsewhere as "under-innovating."[3] The limited scope, however, did include some completed tasks, so that the use of the innovation was associated with concrete outputs, even if they were not the ultimate payoffs by which the innovation was formally evaluated.

Second, the findings have suggested that *the initial use of the innovation should involve as much direct contact with practitioners as possible.* Here, it is again useful to distinguish between task-specific and task-diverse innovations. For the task-specific innovations, direct contact appeared to be facilitated if the innovation was related to a highly repetitive agency function. If the opportunity for using the innovation only occurred infrequently, practitioners had little practice in using the innovation, and few people had direct contact with it or were able to learn its functions. For task-diverse innovations, direct contact appeared to be facilitated if the coordinator identified several service applications that involved an enthusiastic subgroup of agency practitioners. Often, these applications had emerged because

[2] The extreme claim would be that some practitioners' major career advancement has often been based on a successful experience with a single, significant innovation. Often, such a individual can rise to the very top of an agency (as in the recent trend for data processing officers to advance to the heads of law enforcement agencies).

[3] See Lambright and Flynn (1977). However, an important difference is that the present study only regarded "under-innovation" as an interim strategy; ultimately, the innovation must achieve full utilization (passage or cycle number 10), otherwise it will always be regarded as a special situation (e.g., a demonstration project) and not as a standard practice.

some subgroup had supported the innovation's adoption in the first place. Under such circumstances, this subgroup was likely to be highly motivated to help make the innovation become operational.

Third, *as the innovation becomes operational, close attention should be given to the possible ways for expanding its use.* Even a task-specific innovation presented some flexibility in this regard, for an agency did have some discretion in performing certain activities more often than in the past (e.g., more stringent enforcement of laws pertaining to persons who drive while intoxicated or issuance of parking violations). Where such flexibility existed, those supporting the innovation could press for the highest frequency of service use. A task-diverse innovation, of course, presented a wide variety of opportunities for increasing the number or frequency of service applications. Coordinators of the innovation sought to identify these new applications and to extend the innovation's functions to cover them. Each new application did require additional effort and resources, but these requirements were more than offset by the additional practitioner support that occurred.

A critical consideration throughout these initial and expanded activities was whether the innovation could be used as part of the agency's core practices. The "core," as noted in Chapter VII, covered situations in which an innovation displaced a traditional function or created a new function that was then associated with a redefinition of the agency's basic mission. An innovation could also cover a core practice by serving a well-established need that had previously gone unfulfilled. Certain innovations lend themselves to becoming a part of core practice, simply by virtue of their inherent functions. However, other innovations, mainly of the task-diverse type, presented certain choices among applications. In such cases, the coordinator or other supporters of the innovations could direct the use of the innovation to core applications. Actions were also taken to eliminate the superceded practice, where relevant, as effectively as possible.

Finally, throughout the initial and expanded use of the innovation, *explicit attempts should be made to identify payoffs in terms that practitioners can directly experience.* In the case studies, these included convenience, reduced time and effort, job safety, service changes that may make a job more stimulating, and other outcomes that were not necessarily the types of payoffs significant to formal evaluations. The more that practitioners could experience these payoffs, the more they supported the innovation. Sometimes the payoffs to the practitioner were similar to and correlated positively with formal evaluative outcomes—e.g., a speedier and more effective response to health emergencies (an outcome which practitioners can directly experience and will find rewarding) was related to an increase in lives saved (an outcome with which formal evaluations are likely to be concerned). There were occasions, however, when the practitioner payoffs were unrelated to evaluation outcomes. For example, an educational innovation might make a teacher's work easier or more convenient (or more fun) but produce no service benefits such as students' educational achievement or other educational outcomes. Under such circumstances, the findings suggested that the routinization process could still continue.

Research on Strategies for Routinization: II. Organizational Changes

The use of an innovation in the various ways described above should lead to

its growing support among practitioners and agency leaders alike. The argument, in short, has been that when an innovation is used frequently, performs a core practice, and has payoffs meaningful to practitioners, both the practitioners and higher officials within an agency will try to make the innovation an integral part of agency operations. The routinization process was further facilitated, however, if certain organizational changes were also explicitly pursued. These changes were not important during the early period in an innovation's life history, when the main goal was to make the innovation operational by whatever improvisation was necessary. The organizational changes did increase in importance, though, after the initial improvisation period had transpired. Again, the findings suggested the need for further corroboration along the following lines.

The key organizational changes were related to the resources needed by most innovations. Most innovations required budgetary support, maintenance and supplies, trained personnel to administer and operate the innovation, and explicit organizational procedures for linking the innovation to other aspects of agency operations. In general, the innovator or others seeking to routinize the innovation attempted to implement the specific organizational changes that would provide the innovation with these resources. At the outset of an innovation's life history, ad hoc or temporary changes, such as a special in-service training program, sufficed. In the long run, however, the changes had to be integrated with existing agency procedures. The goal, in short, was to establish budgetary support for the innovation that was no different from the budgetary support for the rest of the agency's operations, to establish training programs that were a part of the practitioners' regular training, to have the innovation included in procedural manuals or other rules of governance that also covered all other agency practices, and so on. In some cases, the innovation not only needed to be incorporated into such procedures but also affected them—e.g., a computer innovation affected the way an agency organized its budgeting system. In such cases, the routinization process was more complicated, and innovators had to deal with a dual task—i.e., incorporating an innovation into a set of organizational procedures but also changing the basis for such procedures.

A major distinction throughout all these organizational changes was that some changes required more lead time than others. (This refers simply to the procedural mechanics of making organizational changes, and not necessarily to the time needed to develop political or bureaucratic support for such changes.) The fastest changes often involved maintenance and supply procedures or formal reorganizations of an agency's structure. Changes that required more time to implement were the establishment of personnel classifications, the creation of major modifications in an agency's rules of governance (as reflected in the passage of a city ordinance or a new bond issue), and the eventual promotion of personnel acquainted with the innovation. Chapters V and VI have distinguished between these faster and slower organizational changes by differentiating between the Expansion Stage in an innovation's life history and the Disappearance Stage in the same history. Because of the long lead time, certain organizational initiatives had to be made as early as possible during the innovation's life history; to ignore the development of personnel reclassification actions, for instance, only delayed the eventual creation of the appropriate personnel positions and classifications needed by the innovation.

For innovations that attempted to affect *educational* practices, it was especially important that, above and beyond the development of support among practitioners,

the organizational changes were made in collaboration with the curriculum department (or its equivalent) in the school district. Few changes in core educational practices appear to be made without such collaboration, and most innovations requiring teacher retraining or the redefinition of teaching assignments must also be approved by the curriculum department. In addition, the curriculum department usually had close links with agencies in higher levels of government (i.e., state agencies) that regulated the governance of the school district by granting accreditation, establishing standards, or developing lists of specific textbooks for teachers to adopt. Although these observations regarding the role of the curriculum department may appear obvious, the findings of the present study showed that, in many instances, supporters of an educational innovation were unaware of the critical role played by the curriculum department, and many efforts were wasted because they were not directed at the curriculum department.

Whatever organizational changes were pursued, those supporting the innovation had to deal with a varied group of agency personnel. Each organizational area—e.g., budgeting, personnel, maintenance and supply—had a slightly different power and staff structure, even within the same agency and had to be confronted separately. To this extent, the negotiation of each organizational change was best regarded as an independent task. The composition of the innovating team needed to be enhanced during the Expansion Stage to include sufficient expertise to deal with each task.

In summary, these preceding organizational changes were found to be important elements of any routinization strategy. Further research, testing these notions with other kinds of innovations and in agency settings different from the ones in the present study, would be helpful in corroborating or disproving these findings.

Research on Strategies for Routinization: III. Perceptual and Attitudinal Changes

As previously noted, routinization finally occurs when *both* organizational and perceptual changes have been accomplished. The organizational changes are reflected in the passages and cycles and have been the main concern of the present study. However, further research is needed to investigate the perceptions and attitudes of various groups—practitioners, administrators, and the citizenry—with regard to a range of service practices.

In a longitudinal research design, perceptual norms might be assessed when a practice was new and then compared to those norms prevalent when the practice, on the basis of organizational characteristics, appeared to be routinized. The predicted outcome would be that the perceptions would change over the course of the innovation's life history, and that there would be a perceptual counterpart to the progression through the Improvisation, Expansion, and Disappearance Stages. An alternative design would be a cross-sectional one, in which perceptions of various practices would be assessed. There, the predicted outcome would be that those practices that had already achieved the appropriate passages and cycles would be perceived as "standard practice." Whatever the design, the main point would be to assess perceptions toward practices whose organizational status had also been explicitly defined according to the passages and cycles framework.

C. RESEARCH ON THE ROLE OF FEDERAL MISSION AGENCIES

The policy implications of this further research on routinization have been cast in a form that is presumed to be directly applicable to the needs of *local* decisionmakers. Thus, any corroboratory evidence from new research will hopefully give direct guidance to a local agency head, staff person, or coordinator of some innovation.

The research on routinization as described, however, does not provide explicit guidance for action by *federal* decisionmakers. For federal officials to take advantage of any new knowledge regarding the routinization process in local agencies, the general relationship of federal mission agencies to local service agencies must first be taken into account.[4] The revelant federal mission agencies are those federal departments that encourage and support local innovation. These include:

- The Department of Housing and Urban Development (e.g., programs to support local government innovation in general).
- The Department of Health, Education, and Welfare (e.g., programs to encourage educational and health innovations).
- The Department of Justice (e.g., programs to assist law enforcement agencies and support innovations in criminal justice practice).
- The Department of Commerce (e.g., programs to support innovations in the fire service).
- The Department of Transportation (e.g., programs to improve local transportation services).

Because of their position in the intergovernmental structure, the federal mission agencies can only work indirectly to influence the routinization process in local services.

The Role of Federal Agencies

Any attempt to describe the policy implications for federal mission agencies must be introduced by a discussion of the rationale for federal intervention. This is because local service problems and practices are essentially the purview of local (and in some cases, state) governments and agencies, and the federal role in this context has not always been clear and has frequently been challenged. However, it may be claimed that federal mission agencies do in fact have a major responsibility in supporting innovation—and hence for selectively promoting or discouraging routinization—in local government practice. This responsibility is based on several needs created by the innovative process that cannot be fulfilled by state and local governments acting alone, namely the need for:

- Supporting research and development (R&D) on innovations that may be applicable to local needs.
- Promoting transference and diffusion from site to site, including the creation of networks of technology agents.
- Conducting evaluations.

[4] Increasing attention has been given to problems of implementing federal programs at the local level. See, for example, McLaughlin and Berman (1975), Hargrove (1975), Rein and Rabinowitz (1977), and Bardach (1977).

- Assisting local jurisdictions to deal with problems deemed national in significance.

Supporting Research and Development (R&D). Successful use of innovations by local governments depends first and foremost on high-quality and responsive R&D. Federal laboratories, field agents, and technology centers, as well as federally sponsored university research, constitute a nationwide R&D resource. Although these resources may primarily serve other objectives, as in the case of NASA installations, the R&D expertise can often provide essential technical guidance for state and local efforts.

In this regard, it should be noted that the Jet-Axe innovation was a direct spinoff from technology originally developed for aerospace functions. Similarly, there have been any number of "hardware" and "software" innovations that have received initial federal support and have then been found to be useful by local service agencies. A primary function of federal mission agencies therefore continues to be the support of specific R&D efforts that will produce innovations for local service agencies.

Promoting Transference and Diffusion. Many local governments share similar problems and experiences. Yet, there are so many governmental units at the local level that communications among these units is often haphazard. One community may already have developed a basic approach to a problem that can also benefit another community, even though the second community will still have to modify the approach to suit its unique needs. Without a good communications network, the transference and diffusion of ideas and solutions will be mininal. A second role of federal mission agencies is therefore to support and improve the transference and diffusion of ideas from one local site to another.

Federal support for diffusion can take either of two forms. First, the federal government can encourage the dissemination of information on specific innovative ideas and technologies. An information clearinghouse or the sponsorship of conferences and workshops would be examples. Second, the federal government can explicitly support the development of communications networks. This can take the form of support for extension agents[8] or for professional associations, such as the International City Management Association and the International Association of Chiefs of Police. Support can also be given to emerging groups, such as the emergency medical professions, that deal with new local functions.

Whether for disseminating information on specific technologies or for network-building, the rationale for federal support is based directly on federal, and not local concerns. This is because presumably there is a shared set of problems that goes beyond the boundaries of an individual city. In other cases, there may be a communications system that is actually a *national* network, involving officials from many cities or states. The network is therefore a resource that only the federal government can nurture.

Conducting Evaluations. Evaluative information is needed to provide feedback on project performance and accomplishments. Such feedback may be used to allocate resources in the future. However, most local governments are not equipped

[8] For example, the National Institute of Education is currently assessing the development of educational extension agents and the Department of Energy is examining the role of energy extension agents; both developments generally follow the model of the existing agricultural extension service.

to perform such functions as evaluation research. Nor would it be appropriate for every local unit to have its own evaluation staff. Such a resource would be difficult to develop and would be poorly used. Because very specialized skills are often required and are not frequently available, it is equally appropriate for federal agencies to support the evaluation of local service practices.

For evaluation, federal agencies can serve as an information resource to local governments, recommending specific evaluators or providing guidance on the latest state-of-the-art in evaluation research. In addition, federal agencies can support specific evaluative efforts that cover more than a single city agency. Such efforts can make more economic use of special evaluation skills. Thus, evaluative feedback can be made available to many cities that participate in a single, larger-scale evaluation supported by the federal government. Finally, federal mission agencies can support research on improved evaluation methods. Such methods are needed to assess both organizational and service impacts, as well as to assure that evaluations are conducted as efficiently and effectively as possible.

Dealing with Problems of National Significance. A fourth rationale for federal intervention is based on the federal role in assuring that services are responsive to national needs—e.g., health care, compensatory education, new mass transit facilities, or prevention of crime in the streets—because of their national significance. Even though the problems can only be confronted at the local level, federal resources can nevertheless be mandated by the Congress, and large-scale programs mounted by the executive branch.

Among the innovations covered by the present study, it has already been noted that three—MICU, CAI and CCTV—were in part supported by federal funds under just such a rationale. In addition, federal involvement in the breath-testing innovation has also been based on a similar rationale—i.e., the rising national rate of automobile accidents due to drunken driving.

Summary of Federal Role in Relation to Routinization. These four rationales for federal intervention in agency practices can all be related to the routinization process. Where the federal mission agencies are concerned with the implementation of a specific innovation, for instance, the concern should extend to the point of routinization or institutionalization. Otherwise, a local agency may be unnecessarily disrupted by having to adopt an innovation that is later discarded out of negligence. Naturally, the policy implications that draw from the process are dual-edged. There may be some occasions where routinization should be disrupted, and federal mission agencies can use the same knowledge about the routinization process to create such a disruption. The point of research on routinization would be to provide guidance on how the process can be facilitated or retarded once decisionmakers have selected the desired outcome, rather than to indicate when and where routinization was appropriate (or from whose point of view)[6].

Research on Federal Intervention Strategies

On the surface, federal mission agencies have a variety of policy mechanisms to influence innovation (both positively and negatively). These mechanisms include (but are not limited to):

[6] The text does not deal with the potentially conflicting situations that may arise when it is in the interest of some parties to routinize a practice but contrary to the interests of other parties.

- Revenue-sharing or noncategorical funds to local agencies.
- Funds for extension agents or professional associations to encourage innovation among practitioners.
- Funds for developing specific innovations.
- Funds for testing specific innovations at specific sites (e.g., a demonstration project).

Federal agencies may also set specific performance standards for local practice, thereby providing an indirect incentive for innovation, and any number of federal regulatory actions (e.g., school desegregation) can affect both innovation and routinization.

Political reality probably demands that the entire array of mechanisms continues to be used. Some may receive more emphasis than others, but it is difficult to imagine a whole type of mechanism being completely eliminated. Thus, although there has been a shift from categorical to noncategorical programs in the last decade (beginning with the Nixon administration), the categorical programs are unlikely to be dropped entirely. In other words, the realistic policy alternatives are not to choose among the mechanisms but to improve each mechanism in its own way to facilitate the adoption and routinization of new practices. Any improvements in using these mechanisms will require policy research on such topics as: the synthesizing of lessons from various local experiences; allocating and monitoring the use of federal funds as routinization occurs or fails to occur; and developing a better understanding of local agency processes rather than merely supporting specific innovations.

Synthesizing the Lessons from Local Experiences. Local governments may each operate in unique historical and political settings, but this does not preclude them from having numerous common experiences. For instance, as a result of the energy crisis of 1973-74 and the continually rising costs of energy since then, many school districts discovered that they shared common problems in operating school buildings and attempting to conserve energy.[7] Clearly, many different agencies—as our case studies only begin to suggest—have also had common experiences with the routinization of specific innovations.

Federal agencies need to develop new but simple ways of synthesizing the lessons from these experiences and using them in designing any federal programs aimed at improving local services. For routinization, the issues to be covered might include the development of:

- *A policy-typology of innovations*, extending far beyond the simple distinction between task-specific and task-diverse innovations, which would allow officials to understand what policy implications, if any, have been consistently associated with different types of innovations.
- *A refined understanding of the career paths of local innovators and coordinators*, to determine what types of paths are most closely associated with successful routinization. (For instance, the findings of this study suggested that the stereotypic urban innovator who moves too rapidly from one jurisdiction to another will facilitate the adoption of many innovations but may fail to promote routinization.)

[7] For a fuller description of local service experiences related to energy consumption, see Yin and Gwaltney (1977).

- *Insights into the most (and least) transigent cycles and passages in local agencies* so that future innovators may be forewarned about the need to make early plans for certain types of organizational changes.

These and other topics should be explicitly examined by synthesizing existing research. Ultimately, the lessons drawn can be incorporated by federal agencies into their own programs—e.g., making new awards for demonstration projects, promoting (to the extent necessary) R&D on certain types of innovations, or encouraging professional associations to undertake innovative activities.

Unfortunately, recent research on federal management practices has suggested that federal agencies have had difficulty in synthesizing lessons from the past. Totally new demonstration programs, for instance, have been initiated in one federal department without any reference to experiences with similar programs in other departments. High rates of personnel turnover among federal officials have also helped to create a degree of inconsistency within the same program. How these and other problems of federal management are resolved remains to be seen. However, it may be that greater burdens than in the past will be placed on those federal agencies—e.g., the U.S. Office of Management and Budget or the National Science Foundation—that cut horizontally across substantive program areas.

Allocating and Monitoring the Use of Federal Funds. Previous research has differed in drawing conclusions about the role of federal funds in local service innovation. Many studies, including the present one, have concluded that there is no consistent pattern between the availability of federal funds for a project and the outcomes of that project.[8] Other studies, examining different federal programs or a different sample of projects, have in contrast found federal funds to facilitate desirable outcomes.[9]

These conflicting results can be explained if one distinguishes between *indiscriminate* and *impotent* effects. Indiscriminate effects occur when there is no discernible pattern across an array of projects; impotent effects occur when there is no measurable effect for any single project. The conflicting results from previous studies, as well as the case study examples in the present research, suggest that the main discovery has been one of indiscriminate but not of impotent effects. In other words, there have been numerous instances in which a specific innovative experience was critically assisted by some federal funds, so that the funds were hardly impotent. The negative findings that often emerge are of the aggregate patterns across numerous projects—which include many situations in which federal funds were indiscriminately applied—and the negative or null experiences served to (statistically) offset the positive or successful experiences. An important question for further research is therefore to identify those situations in which federal funds can have a potent effect on local innovations.

For routinization, this could lead to major advances in applying federal funds more discriminately. Presently, most awards of federal funds (where funds are not distributed on a strictly formula basis) are based on grant or contract applications that only emphasize the early steps in the innovative process. For instance, applications may provide considerable detail about how a project is to be started and implemented but give no clue as to any routinization plans even when a multi-year

[8] For example, see Lambright and Flynn (1977).
[9] For example, see Bingham (1976).

award is involved. The only long-term concern, if any, is whether there is a plan for local funds to eventually substitute for the initial federal funds in supporting the innovation. The present findings have suggested that federal agencies should alert applicants to the need for achieving certain tasks that we have called passages and cycles, and that applicants should present preliminary plans for achieving these tasks. At the outset, the plans may be no more than a sketchy outline. However, after the first six to nine months of a project have passed, these plans could be described in greater detail.

Some of the questions that might be raised from the perspective of a federal official in evaluating an application and in monitoring subsequent progress might include the following:

INITIAL FACTORS

1. Does the type of innovation suggest the need for a full-time coordinating role? If so,
2. What is the proposed coordinator's background, turnover history, and relationship to agency practitioners?
3. Is there any evidence that the proposed project fits the unique needs of the local agency at this point in time?
4. Is there an adequate training program for the first cohort of users of the innovation?
5. Does the proposed project staff have a technical grasp of the innovation, and is there a plan for dealing with maintenance, repair, upgrading, and depreciation problems?

ORGANIZATIONAL FACTORS

1. What steps have been taken to avoid status as a special project (e.g., avoiding special budget lines, temporary personnel appointments, or a special organizational unit that does not match existing agency units)?
2. How is the innovative practice to be assessed, and do these criteria include meaningful payoffs in terms of practitioner needs?
3. How does the innovative practice compare with other agency priorities for ultimately using local funds?
4. How is the innovative practice to be integrated with existing personnel classification and certification procedures?
5. What are the possibilities for personnel promotions as a result of using or administering the innovation?
6. What is the plan for making changes in the regular practitioner training program to incorporate whatever new skills are needed to use the innovation?

A dilemma that arises in applying these questions to any award or monitoring procedure, however, is that federal intervention can become so cumbersome that local projects will have difficulty in simply getting started. Thus, further research is needed to show how the concerns reflected in these illustrative questions can be addressed without such interference. For example, the routinization questions might not be considered in detail at the outset of a new project. The main point is that federal officials should have a complete agenda to guide themselves as a project

progresses. The federal officials will have to think in longitudinal terms to develop a series of changing criteria for monitoring local progress, clearly going beyond the current attention to writing effective Requests for Proposals (RFPs).[10]

Developing a Better Understanding of Local Agency Processes. Skepticism has continued to grow about the benefits of federal intervention for local services.[11] This is partly because the large-scale federal programs of the 1960s were accompanied by unreasonably high expectations (which, one author has pointed out, have not been typically applied to defense expenditures—where many federal dollars may be wasted in testing a new system such as the B-1 bomber).[12] In addition, federal programs have often entailed long delays and bureaucratic harassment, to the point that capable local agencies are now "capable" not only in the sense of being able to provide service but also in being able to obtain federal grants.

More disappointing, the Washington view of urban service problems is still poorly informed about local agency processes—i.e., the way that local agencies conduct their everyday business. The importance of the textbook adoption process (usually involving a state and local educational agency), for instance, went unappreciated throughout early attempts to reform education.[13] No matter what reform measures might be considered by federal officials or outside experts, the implementation of new service practices can only occur through the use of existing organizational procedures such as the textbook adoption process.

Any federal intervention program must therefore be designed around the existing context of local agency operations. This context includes the observation that local agency operations:

- Are often designed to serve patronage and not performance criteria;
- Have low rates of lateral entry, so that the senior officials of an agency have often spent their entire careers within the agency;
- Are vertically connected to the intergovernmental system through a maze of county, regional, state, and federal agencies; and yet
- Retain certain functional similarities across different local jurisdictions (e.g., police departments in two different jurisdictions retain a basic resemblance to each other).

In addition to improved synthesizing of local experiences and use of federal funds, federal mission agencies can also support new research that will improve knowledge about this context and about local agency services. For the routinization process, research is needed for at least four purposes:

- To corroborate the present findings in an independent study or studies.
- To determine the degree to which the findings can be generalized to other types of innovations and public or private organizations.

[10] For an illustrative discussion of how to improve RFPs for soliciting evaluation research, see Weidman (1977).

[11] For instance, see Pressman and Wildavsky (1973) and Bardach (1977).

[12] W. Henry Lambright, *Governing Science and Technology*, Oxford University Press, New York, N.Y., 1976.

[13] For a description of the local educational policy context, see Suzanne K. Quick, unpublished Ph.D. dissertation, School of Education, Stanford University, January 1978.

- To elaborate the routinization process in greater detail, covering both the various outcomes and causal factors.
- To develop more refined measures of organizational change, so that multivariate analysis can be conducted in the future.

The first two purposes could both be served by the same study or series of studies. The research design should include explicit attempts to replicate a portion of the present findings by selecting at least one or two of the same innovations, as well as attempts to extend the findings by selecting other innovations and other types of organizations for study. It would be particularly useful to know whether: (a) the routinization process that has been described here is limited to local services—and is found in *private* local services as well as public local services (e.g., private police, private schools, private sanitation collection); (b) the routinization process is a characteristic of public organizations—and is found in federal as well as local agencies; or (c) the process is even more generalizable to a wide variety of organizations and innovations.[14]

For the third and fourth purposes of elaborating the routinization process in greater detail and developing better measures of organizational change, a schematic drawing can provide a common basis for discussing specific types of further research. Figure 2 shows the main stages in the life history of an innovation, as the innovation changes over time from a new to a standard agency practice. The highlights of the life history are the three stages shown in the three boxes, with each stage defined according to the achievement of certain passages or cycles. Most of the relevant organizational forces that move an innovation from one stage to another are briefly listed next to the arrows supporting each stage, and a circle is used to represent those situations in which a traditional practice has been displaced by the innovative practice. Of course, the fully routinized practice (represented by the *Disappearance Stage*) can itself become a potential candidate for displacement by yet another innovation at some later date.

A major priority for further research would be to determine the general mutability or immutability of the routinization process in greater detail, with interval measures that would facilitate multivariate anaysis. It may be, for instance, that certain early conditions during the decision to adopt will supportively facilitate the ultimate routinization outcomes. If so, policymakers would have a potent instrument for change because the conditions surrounding the adoption step might be easily manipulated. There is an interesting problem that arises from this mutability issue. On the one hand, routinization appears to be a fragile process, with many innovation life histories becoming abortive before full routinization has been achieved. On the other hand, many service practices appear to be extremely difficult to supplant or terminate once they have become routinized.[15] These apparently disparate organizational phenomena may ultimately be explained by the same set of factors; that is, *the same new knowledge that will make routinization a less*

[14] One easily implemented research strategy to test these notions would be to develop a cross-sectional design, in which "standard practices" are analyzed in operational terms in a wide variety of organizations and with a wide variety of practices (that had once been innovations). If the simple descriptive results were similar to the present findings, the basic argument for a highly generalizable routinization theory would have been established, and further studies could explore the actual process in each type of organization.

[15] See the special issue of *Policy Sciences*, Vol. 7, June 1976, whole issue, for several articles on the topic of program termination.

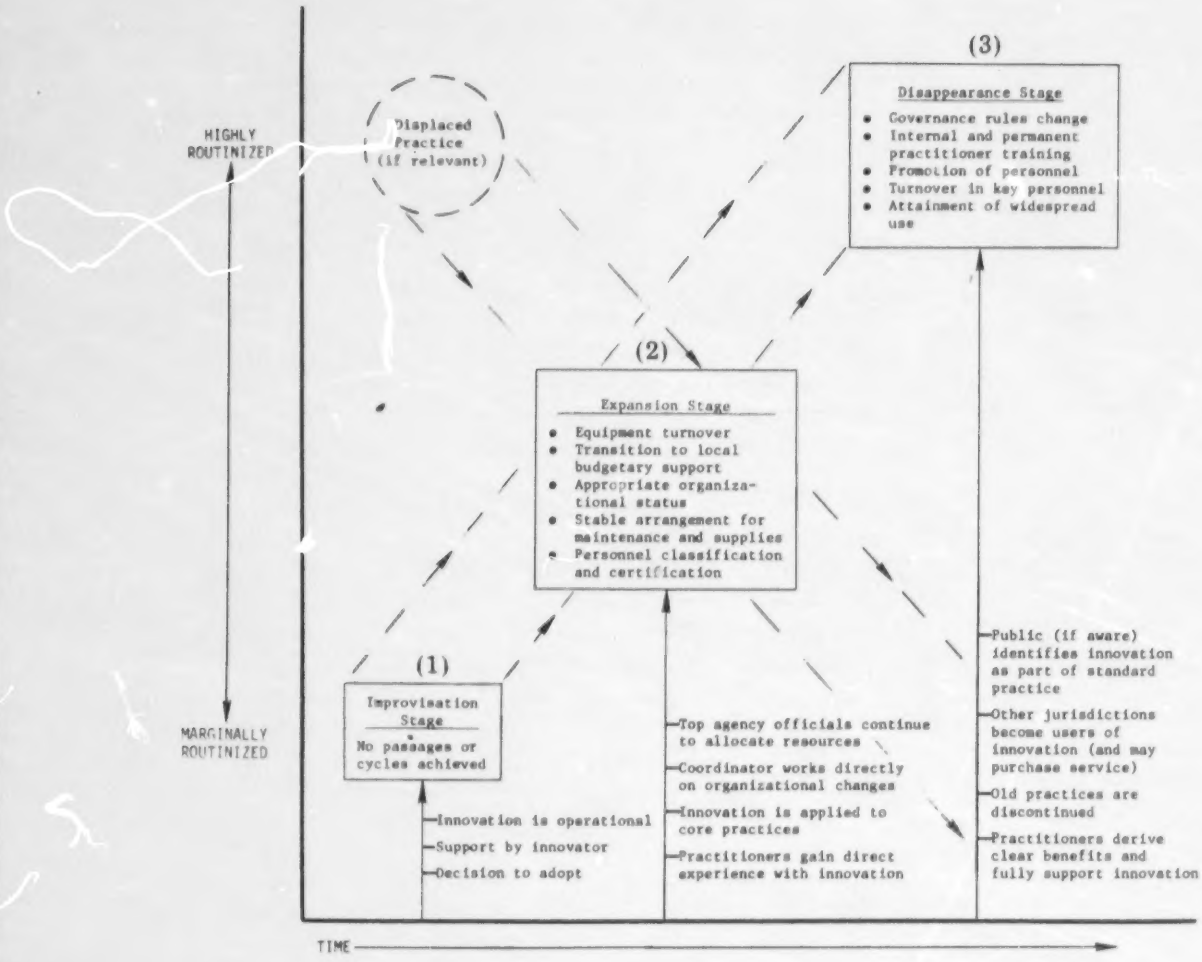
HIGHLY ROUTINIZED
MARGINALLY ROUTINIZED
Displaced Practice (if relevant)
(1)
Improvisation Stage
No passages or cycles achieved
(2)
Expansion Stage
• Equipment turnover
• Transition to local budgetary support
• Appropriate organizational status
• Stable arrangement for maintenance and supplies
• Personnel classification and certification
(3)
Disappearance Stage
• Governance rules change
• Internal and permanent practitioner training
• Promotion of personnel
• Turnover in key personnel
• Attainment of widespread use
Innovation is operational
Support by innovator
Decision to adopt
Top agency officials continue to allocate resources
Coordinator works directly on organizational changes
Innovation is applied to core practices
Practitioners gain direct experience with innovation
Public (if aware) identifies innovation as part of standard practice
Other jurisdictions become users of innovation (and may purchase service)
Old practices are discontinued
Practitioners derive clear benefits and fully support innovation
TIME

Fig. 2—Complete life history of a local service innovation

fragile process is also likely to make program terminat on an easier achievement for policymakers.

Research should also focus on the specific importance of individual passages and cycles and the factors that lead to their achievement. Because the present study was the first to explore the routinization process, an explicit assumption had to be made regarding the equal importance of each passage and cycle. However, certain passages or cycles may in fact be more critical than others, given specific types of innovations or agency settings. Wherever this is the case, intervention techniques can be designed to be more precise and effective. Taking but one example, the life history of an innovation during the Expansion Stage may be critically impeded or advanced by the degree to which the appropriate personnel classification and certification procedures can be established. Because personnel systems in most munici-

pal civil services operate very slowly, it may therefore be essential that some groundwork be conducted during the Improvisation Stage; further, federal agencies or other supporters of the innovation may want to have early signals that such personnel changes are possible and might want to include information about the existing personnel procedures in early reviews of the innovation's progress. If an agency has had chronic difficulties in obtaining new classifications of any sort, the supporters of the innovation will have been forewarned that extra efforts will have to be made or that routinization is not likely to occur.

D. CONCLUSIONS ON FURTHER POLICY RESEARCH

The findings of the present study should be regarded as but one source of new information for policy guidance. Other research and experiences will also have to be integrated to develop a firmer set of directives. Nevertheless, the study has suggested many steps that, if confirmed by further research, will allow local policy officials to assess and influence routinization.

For federal mission agencies concerned with improving local services, policy implementation will involve both the substantive steps directly related to routinization as well as improvements in federal program management itself. Regardless of the firmness of our knowledge about routinization, no routinization strategies can be pursued unless federal agencies are also prepared to organize themselves more effectively to synethsize the lessons from local experiences, to become more sophisticated in allocating and monitoring the use of federal funds, and to support further research on local organizations.

The problem of delivering neighborhood services to residents—i.e., ensuring public safety, increasing environmental safety, and providing adequate educational, public health, sanitation, and recreational services—has now become a problem for governments at all levels. It is impossible to return to the simplistic era when municipal governments alone could manage these services. Intergovernmental coordination has become a fact of life, but the design of effective policies can only be based on an improved understanding of how actual service practices emerge and become routinized.

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